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THE BATTERING RAM AS A TUNNEL BORER.

Mr. Charles Bergeron, C. E., in a recent issue of the *Engineer*, contributes a paper on the St. Gothard Tunnel, and more especially relating to the modes of drilling which have been adopted. The Dubois and François perforators, which are of more simple construtions and of higher efficiency than the similar machines employed at Mont Cenis, have been mainly employed, but more recently the McKean apparatus has been substituted. Compressed air is furnished at a pressure of from five to eight atmospheres, by means of three powerful turbines of 220 horse power each, forming a total amount of 660 horse power, at each end of the tunnel. With such powerful engines, M. Favre, the contractor expects to execute three blastings by dynamite per day, advancing each time 4·8 feet at each end of the gallery, the entire extent of which it is believed will be completed in less than five years.

Mr. Bergeron, in considering the plans of M. Favre for the use of dynamite, points out a number of different operations, as well as objections incident to the employment of the same, and thinks that there is a way of accomplishing the work in less time and with a much smaller amount of trouble and inconvenience.

In making their long subterraneous aqueducts, it is stated that the Romans used a battering ram to pierce the way through rock. This engine consisted of a long wooden beam suspended at its center of gravity and heavily weighted. A number of men on each side, acting together, gave it a swinging motion, so that it struck with great force any obstacle in its path. When the instrument was to cut hard rocks for tunnels, the metallic head was armed with points like a stonecutter's hammer, intended to divide and reduce the stone to fragments or dust. Captain Penrice, an English engineer, some time ago conceived the idea of constructing a rock drill on the same principle, and to employ steam or compressed air for pushing, like a steam hammer, a perforator of four or five feet diameter. This was tried in the Vaugirard quarries near Paris, and made five feet advancement per hour; and since, another has been built, 3 feet 6 inches in diameter, which, it is asserted, will penetrate a distance of from two to three feet in similar time. By suitable mounting of the cylinder on the trunnions of a gun carriage, it can be made to take all the positions of a marine or siege gun, and strike the rock with blows of eight or ten tuns weight. The hammer weighs two tuns and a half. The engraving of the apparatus will render its construction clear. A is the framing, suspended on the wheels, B B. The end wheel serves to direct the carriage, and the whole is moved forward by the aid of the hand spike, Fig. 6, inserted in the holes, O O, in the wheel, B. D is the steam cylinder, mounted on trunnions, and its angle is determined by the segment, N, and pinion and handle, M. E is the valve chest; K, the hand lever by which the valve is actuated; H′ is a heavy balance weight; H is the ram head fitted with cutters, shown on an enlarged scale in Figs. 2, 3, 4, and 5. The holes, O, are used to extract the cutters when worn. J is the air pipe, to which a flexible pipe is attached. By moving K backwards and forwards, H will be made to act as a battering ram on the face of the heading in a way that will be obvious.

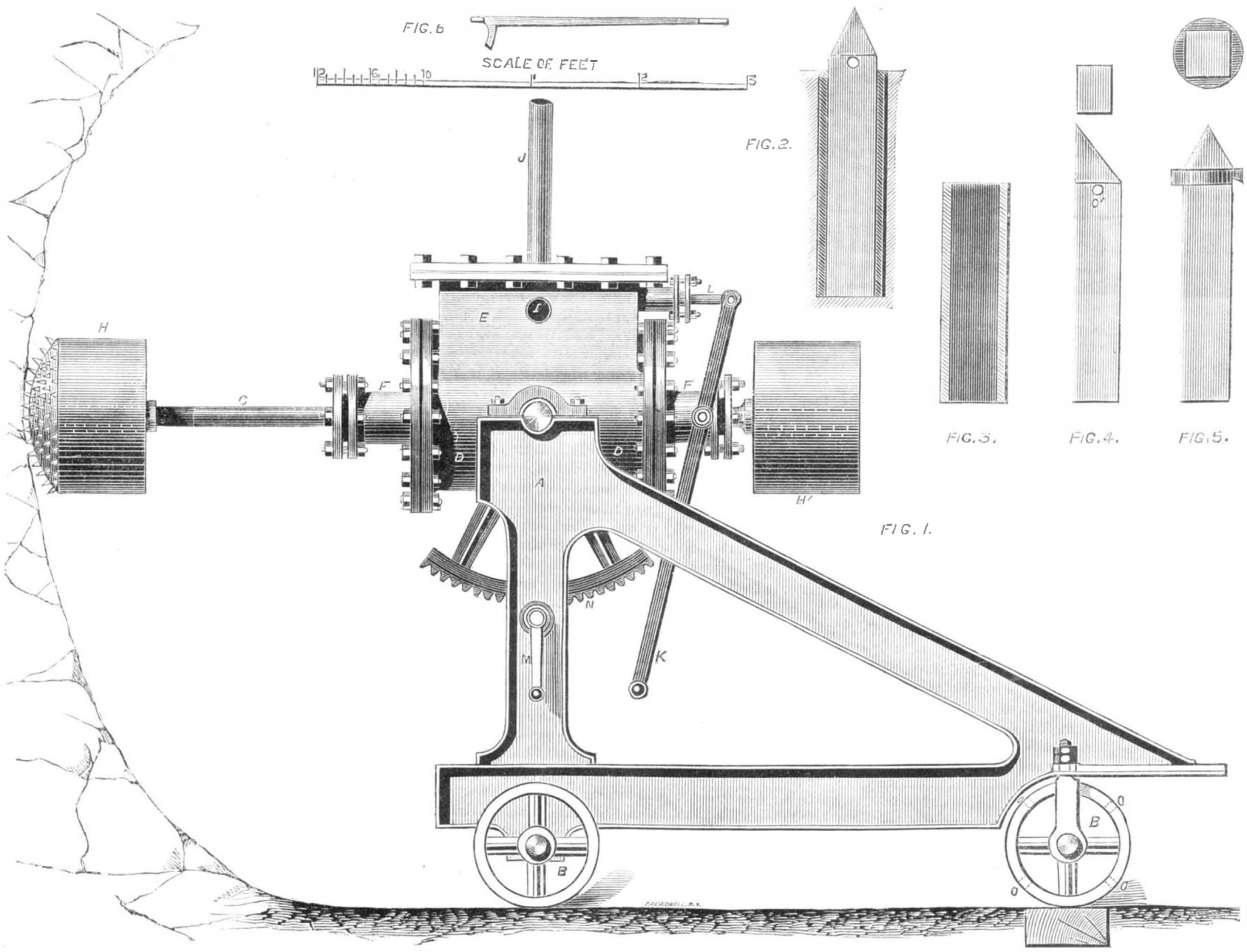
The gun carriage may be placed upon a turntable; and jets of water, projected against the place where the hammer is striking, will serve to carry off the rubbish. The operation would suppress the transport of the latter by wagons; and the work, it is stated, would be continuous, which is not the case when blasting the rock by gunpowder or dynamite.

In connection with the St. Gothard tunnel, we note that, up to November 30, 1873, the drift had reached an extent of 3,353 feet. The total length of the bore is to be 47,680 feet.

PURE glycerin should not produce, when locally applied, a burning sensation, which it always does when the fatty acids are not all extracted. But even absolutely pure glycerin, when undiluted, is a water-extracting body. It should therefore, when used as a cosmetic, or for medical application, be always diluted with water.

Uniform Mean Time.

The extent of the territory of the United States forbids the adoption of one mean time for railroad use, found so convenient in the countries of Europe. It is therefore the practice, on our railroads, to run by Portland time, New York time, Altoona time, or by the mean time of some other center of railroad traffic. The Pennsylvania Railroad and some of its dependencies, extending from New York to St. Louis, use Pittsburgh time, which is transmitted by electricity from the Allegheny observatory, an astronomical clock of the best construction being used. This clock is regulated by a telescope, aided by other mechanism, such as the chronograph, which records, by the aid of electricity, the time that the clock keeps, to the hundredth part of a second. The telescope shows its return, every twenty-four hours, to the point of observation of a fixed star, so that the earth itself becomes the regulating clock of the observatory. Four lines of telegraph, says the *American Exchange and Review*, enter the observatory, one of which connects with the railroad wires. The circuit is led through the standard clock, in which a wheel with sixty teeth revolves once a minute. One of the gold terminals of the wires is in contact with a jewel, which is moved slightly every second by a passing tooth. At this instant the circuit is broken, and, by filing away some of the teeth, certain beats may be omitted, to designate the end of the minute, while another piece of mechanism holds the circuit open for the last minute in each hour. The action is purely automatic and continuous, and the clock beats are repeated, through the twenty-four hours, in the principal offices at Pittsburgh, with which they are united by a line specially devoted to their use. At a certain hour the current is switched into the main circuit, and then the clock may virtually be heard ticking in New York and Chicago, and at every intermediate station, at the same instant. The system has been in use, as the official standard of the Pennsylvania Central Railroad and its eastern connections, for some years; more recently it has been extended to the western roads. The aggregate length of main and branch lines thus supplied is several thousand miles.



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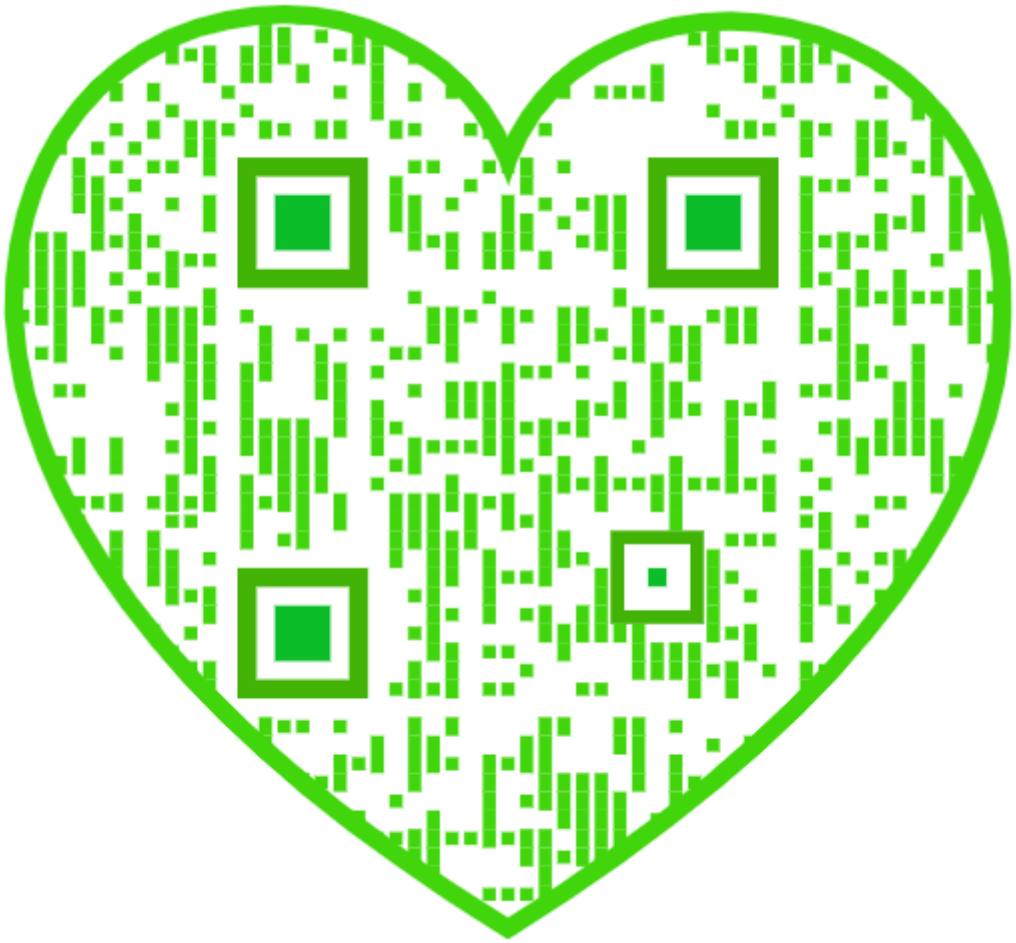

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THE STATE OF THE IRON TRADE.

The present condition of the iron trade of the country is fully set forth in the recent report of the American Iron and Steel Association. Rather a discouraging view is taken of matters on the whole, and to the panic is ascribed a state of affairs on which no immediate improvement is predicted. The question of British competition is dwelt upon at length; and judging from the tone of the English industrial journals, there seems foundation for the belief that the foreign iron masters expect a reduction of duties in their favor, and, in any event, can afford to reduce their profits and continue shipments. The report strongly deprecates any reduction of tariff and advocates an increase, pointing its argument by citing the fact that during last year the British ironmasters sent to this country 371,164 tuns of iron and steel, valued at $25,000,000, and this while our own blast furnaces and rolling mills were lying idle. In other words, we paid to foreign manufacturers, prices for their goods which our own producers would, in the time of their distress, have been glad to have accepted.

In discussing the effects of the panic, it is stated that the home iron trade was more injuriously affected than any other industry. During December, signs of a revival appeared and some pig iron changed hands at a very low rate, but many of the sales then effected were merely speculative. January has been dull, and the present month has opened with no brighter promise. The stoppage of railroad orders is considered as the principal cause of the depression, for the reason that fully half of our iron production and importation has ordinarily been required for locomotives, bridges, car wheels, relaying tracks, etc. Until the railroad companies re-enter the market, there can clearly be no general improvement in any branch of the iron business. Subordinate causes of the continued dullness may be found also in the interruption caused by the panic in all operations largely requiring iron, and in the enforced economy of the people in dispensing with minor articles of iron manufacture which they could temporarily do without.

At the close of 1873, there were 650 blast furnaces in the country, which were either making pig iron or were prepared to make it. From 385 of these, reports have been collected and tabulated. Assuming that a proportionate number of the furnaces not heard from were out of blast and had a proportionate quantity of tuns of pig iron on hand or unsold on January 1, 1874, the total number of stacks at that date, out of blast, would be 233, or thirty-six per cent of the whole number. The total amount of pig iron on hand or unsold would be 520,726 net tuns, and the number of men out of employment, 21,141.

Fifty out of the fifty-seven rolling mills have sent returns. Of these 17 were running, December 31, 1873, 10 on full and 7 on half time; 33 were standing; 11,490 men were wholly unemployed, 10,150 were at work at half time; 37 mills were not selling rails, and there were 36,744 net tuns of rails on hand and unsold at the above date.

This exposition of the state of the two leading branches of the trade is, at best, far from encouraging. Over 30,000 hands are wholly unemployed; and this aggregate does not include ore and coal miners, not directly connected with furnaces or mills, and who are also thrown out of work from the same causes. The iron ore statistics of the Lake Superior region show an increase in the amount shipped for 1873, as against that of 1872, of 211,002 tuns gross. Much of the ore, however, mined was not shipped, owing to the panic. At the beginning of 1873, the price at Cleveland, for first class Lake Superior specular ore, was $12; during the panic this fell to $10, and it is believed that for 1874 the price will be as low as $9. Iron Mountain ore will be $8 delivered at St. Louis.

The total number of miles of railroad in operation, January 1, 1874, was 71,109, as against 67,104 a year back. Increase, 4,005 miles built, or considerably less than the figures of 1872, when 6,427 miles were constructed.

The report gives extended statistics of the comparative status of the British iron trade. The total export of 1873, of iron and steel, was 2,959,314 tuns, estimated at $188,897,940 less in amount than for either of two previous years, but greater in value. The export to the United States has fallen off fully one half; the figures for 1872–3 and 4, being 840,085, 795,734 and 371,164 tuns. During the latter part of 1873, there was a decline in the cost of fuel and labor, which bids fair to be permanent, and the coming year, it is believed, will witness lower prices for iron in the British markets than prevailed during the previous year. The vessels built on the Clyde were 194 against 227 in 1872; the tunnage, however, exhibits considerable increase. The coal trade is said to be a reflex of the iron business, with declining prices as the rule.

The Iron and Steel Association is now in session at Philadelphia, and all the great establishments are fully represented. Such a gathering of capital and influence has never taken place in any iron convention, heretofore held in the United States. A memorial has been prepared for transmission to Congress, which prays for the repeal of the substance of the ten per cent reduction act, passed in 1872, affecting a large number of staple articles, suggests amendments to the bankrupt act, protests against proposed alterations in the tariff laws, against changes in the customs duties to be effected by laws now pending in the House, advocates the establishment of a department of industry, with subordinate bureaux of agriculture, commerce and manufactures, and discusses financial topics and a protective policy.

Two objects of considerable interest have thus far been exhibited. One is a twisted steel Bessemer rail from the Joliet Iron and Steel Company's Works, which is a beautiful piece of work, the rail being made into a complete spiral without developing the slightest flaw or fracture. The other is an ingot of steel, weighing 1,000 pounds, made direct from the ore, for the first time in this country, by the Blair Iron and Steel Company of Pittsburgh.

The proceedings of the convention bid fair to be of considerable importance, and will be made the subject of future comment in these columns.

OZONE—A NEW AND CORRECT METHOD OF SUPPLY.

The use of ozone as a disinfectant in hospital wards and public buildings has amply demonstrated its virtue as a purifier of air exhausted by breathing or poisoned with emanations from corrupt or decaying organic matter. The only bar to its more extended use has been the lack of a simple and trustworthy means of generating it, safely and continuously, by a process not involving scientific skill or costly materials.

The latest means suggested certainly bears the palm for simplicity, cheapness, and accessibility to all. It consists simply in the exposure to atmospheric action of common phosphorous matches moistened by water, the alleged result being the production of nitrite of ammonia and ozone—both active purifiers of air.

Knowing the efficiency of moistened phosphorus as a generator of ozone, the author of the match method, Mr. Sigismund Beer, of this city, set out one day to procure a quantity of that substance to use in sweetening the atmosphere of a room whose musty smell had successfully resisted the power of ordinary disinfectants. Failing to find any phosphorus at the drug stores in his neighborhood, it occurred to Mr. Beer that possibly lucifer matches might furnish the needed element in a condition suited to his purpose. He tried them, dipping them into warm water for a few moments, then suspending them in the obnoxious room. Their effect was prompt and salutary; and thereafter, by continuing their use, he was able to enjoy "the luxury of pure and refreshing air," notwithstanding the room was in the basement of an old cellarless house on made land, the air of which was further tainted by a quantity of moldy books and papers. In a paper lately read before the Polytechnic branch of the American Institute, Mr. Beer narrates a number of subsequent experiments with the same simple materials, the success of which convinced him that he had made a veritable discovery of great importance.

Touching the safety of the method he proposes, Mr. Beer is confident that no overcharging of the air with ozone or other injurious matter may be apprehended from the use of matches in the manner he describes. Both the ozone and the nitrite of ammonia are generated slowly, and their force is swiftly spent by combination with the impurities they are intended to remove. It is obvious that the supply of the purifying agents can be easily regulated by increasing or diminishing the number of active matches. In the room above mentioned, six bundles of matches were kept active—some near the ceiling, others near the floor—by daily watering.

In another instance a single bunch is mentioned as having sufficed for quickly purifying the air of a room in which several adults and children were lying sick, but in this case the air was fanned against the matches while they were carried about the room, thus hightening their activity. How long a match retains its ozonizing power, Mr. Beer does not say. In conclusion, Mr. Beer claims that, whatever may be said of his theory of match action, the fact is indisputable that, in the use of matches as he suggests, we have a handy, wholesome, and inexpensive means of freeing our houses from noxious exhalations and the long train of evils attendent on the prevalence of bad air. The matter is easily tested and certainly well worth trying.

EDUCATION AND BOOK KNOWLEDGE.

The high water mark of a very prevalent theory in education is reached in an assertion, by one of the foremost educators of the day, to the effect that what a man can write out fully and fairly concerning any matter, *that* he knows, and no more. Whatever falls short of this simple and certain test, we are told, is no better than sheer ignorance.

The phrase expresses, with axiomatic terseness, the controlling spirit of the schools; and for this reason, we suppose, it has been echoed right and left as a settled dogma in education. From the primary school up to the highest, excepting a few scientific schools, the grand test of knowledge is verbal expression. The pupil that recites best wins the prize; and as the most credit goes to that teacher whose pupils meet the standard required most completely, the tendency is to narrow the range of teaching to those things which can be most readily reproduced in formal phrases. The premium is paid for words, and naturally the teacher gives more attention to them than to the pupils' mental health or mental development.

Not that facility of verbal expression is to be despised or neglected. It is an art second to none, and worthy of proportionate culture. In many cases it is also a first rate test of knowledge; but to make it the ultimate test, in all cases, involves a double fallacy, subversive of the highest aim in education. It implies that all knowledge worth having can be expressed in words, and consequently can be communicated by words, either for informing another or for testing his information. It implies, too, that the possession of knowledge necessarily carries with it the power of ready and accurate expression.

The fact is, on the contrary, that relatively but a small part of what one may know can possibly be expressed in words; and much, even of that which can be formulated, may be thoroughly apprehended and practically used by one who could not begin to set it down in logical sentences.

Time was when book knowledge was thought to be the sole basis of scholarship. All teaching was book teaching, and it was no more than fair to expect students to prove their knowledge in book fashion. But that time is past. The bookish estimate of culture no longer satisfies. The library alone can no longer make a scholar; and every scheme of culture which pins the pupil's attention to letters is little better than a wall set round him to keep him from learning what he ought to know. That much of what passes for legitimate schooling is such a wall is recognized by everybody except the pedagogue.

Men of real culture are well aware that ability to do is vastly superior to ability to say; and they believe that the development of skill and power ought to receive at least as much attention in schooling as the mere accumulation of second hand facts; but all that sort of basic culture is not merely slighted but suppressed as soon as the test of verbal description is made supreme.

There are less than fifty sounds in the English language. If they were all devoted to the service of a single sense, all their possible combinations would be insufficient to express the distinctions which that sense might be able to recognize. There are five thousand times fifty fibrils in the optic nerve, as estimated by Helmholtz, each demonstrably capable of conveying many degrees of sensation of the several primary colors. One need not calculate the permutations of two hundred and fifty thousand to realize how meager the richest possible vocabulary of sight terms must be for the expression of sight experiences. Still greater is the poverty of language when used for expressing the infinite distinctions of thoughts and things which the whole man is capable of apprehending. Relatively, indeed, our words are but a clumsy sort of currency for certain common needs, no more sufficient for the complete expression of thoughts and feelings than bank notes are for the measurement of values. For the grosser exchanges of life, for marketable values, money answers well enough; but how shall one express in banker's figures, or set phrases either, the value of a kindly word, a mother's love, or a cup of water to one perishing of thirst?

The killing fault with the scholastic test of knowledge is that, from its nature, it fails to reach—as it fails to encourage—more than a single phase of culture, and that one of inferior grade. It measures verbal acquisition only, not skill or power; and since conduct rather than words, ability to do rather than facility in saying what has been done or ought to be done, is the ultimate test in life, and should be the paramount aim in education, the word test is necessarily deceptive as well as inadequate. The glib art critic, scarcely able to draw a straight line, might have at his tongue's end a greater array of fine art phrases than a Michael Angelo; and if suddenly called on to write out fully and fairly his knowledge of sculpture or painting, the master might be beaten by the mere theorist. So, too, the veteran shipmaster of a hundred successful voyages might make off hand a poorer display of nautical knowledge than the cadet fresh from the naval school, or possibly the concoctor of sea stories for a sensational newspaper.

THE IRON ORES OF MISSOURI.

The principal portion of the report of the Missouri Geological Survey for the past year is devoted to the iron ore deposits, which give the State so high a rank for mineral wealth. The geology of Pilot Knob and its vicinity is discussed by the chief geologist, Mr. Pumpelly, while Dr. Adolph Schmidt furnishes a general report on all the iron ores of the State. It is needless to add that the information thus given adds immensely to our knowledge of the character, distribution, and modes of occurrence of these interesting deposits.

Two principal mineral species are represented in the Mis-

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souri iron ores, the hematite and the limonite (sometimes called brown hematite), the former occurring in two distinct varieties, namely, specular ore and red hematite. The first variety is found in the midst of broken and partially disintegrated porphyry, and in the (geologically) overlaying lower silurian sandstone. The red hematite forms strata in the carboniferous system. The limonites occur chiefly as deposits on the second and third magnesian limestones, except in the Osage River district, where they lie on subcarboniferous limestone. Besides these four classes of original deposits, Dr. Schmidt recognizes with each a secondary class of disturbed or drifted ores, making in all eight distinct classes of deposits.

The region of workable iron ore reaches north of the Missouri River at one point only, in Callaway county, where red hematite occurs in the subcarboniferous. South of the river, deposits are frequent throughout the whole southern part of the State. That portion richest in iron ores, however, is comprised in a broad belt crossing the State in a direction about parallel to the course of the Missouri river, between the 30th and 40th township lines. This belt is divided into three distinct regions. The first and more easterly embraces the deposits of limonite in the counties of Ballinger, Wayne, and Madison, and the small but immensely productive Iron Mountain district, with its two enormous deposits of specular ore in porphyry, Iron Mountain and Pilot Knob, besides numerous smaller deposits. The second or central region comprises the deposits of specular ore in sandstone, chiefly in the counties of Crawford, Phelps, and Dent. The third region contains the limonite and red hematite deposits of the Middle and Upper Osage, a district too remote from present markets to add very much to the immediate wealth of the State.

The oldest as well as richest deposits are in the iron-bearing porphyries of the eastern district, a formation regarded as a near equivalent, in point of age, to the iron-bearing rocks of Lake Superior, New Jersey, and Sweden. The deposits occur in the most variable shapes, and of every variety of size. There are regular veins as in Shepherd Mountain and Iron Mountain; regular beds as in Pilot Knob and in some localities east of it; irregular deposits, some of which approach veins by their shape, as in Lewis Mountain; while others have proved to be but isolated pockets, as on Hogan Mountain. In all cases, however, the mode of their formation is thought by Dr. Schmidt to have been practically the same, that is, by precipitation from iron-bearing waters, as ore deposits are still forming in numerous localities from the waters of chalybeate springs. The geological history of Iron Mountain affords a fair illustration of the manner in which the formation of all these beds of specular ore may be interpreted.

Originally the mountain was composed of porphyries, which also filled the valley east and south. In process of time the porphyries became fissured, by contraction or otherwise, and during long periods these fissures were kept filled with constantly renewed chalybeate waters, which slowly deposited the oxides of iron which they contain. As the fissures were gradually filled, the flow of the iron solutions was lessened and finally stopped. Then the ore dried, undergoing thereby a small contraction, which cracked and broke most of the veins without displacing the parts. Subsequently the porphyry was acted on by atmospheric or other waters, probably containing carbonic acid, which decomposed the rock, removing the alkalies and leaving a silicious clay. By the after erosion of the softened masses by rain and flood waters, the cracked and disjointed ore veins lost their support and fell to the ground, thus forming the beds of surface ore which cover the slopes of the hill and fill a part of the valley.

In the main body of the hill, the ore masses remain undisturbed, with more or less decomposed porphyry between, the ore constituting but a small percentage of the entire volume of the hill. The surface layer of ore boulders, pebbles, and ore sand, with very little clay, was originally from four to twenty feet thick, and must have represented a vast amount of erosion. The Iron Mountain ore may be taken as a type of all the Missouri specular ores. It is nearly pure peroxide, containing about seventy per cent of metallic iron, and is nearly free from mechanical admixture of foreign matter. Color, bluish black to steel gray. The surface ore is a little richer than the vein ore and has less phosphorus; both are nearly free from sulphur. Dispersed through all the Iron Mountain ores are magnetic particles, which can be separated from the mass with a magnet when the ore is reduced to powder. No ore with active magnetism, constituting a natural magnet and attracting iron filings, is found on the mountain. The Pilot Knob ore is slightly peculiar; color, steel gray to pearl gray, with a marked tint of sky blue. Its structure is crystaline to granular, with a very fine grain None of these ores affect the compass needle, though all are slightly attracted by a magnet when ground fine. The quality is less uniform than that of the Iron Mountain ores, the principal impurity being silica. The proportions of sulphur are very small.

The ore from Shepherd Mountain is a little more like a magnetite than any other ore in Missouri, but in the main is a specular ore, very similar to that of Iron Mountain. Its magnetic qualities are much more pronounced than those of either of the ores above described, many specimens being strong natural magnets. The ore is very uniform in chemical composition, very rich in metallic iron, and almost entirely free from phosphorus and sulphur. It is nearly as rich as the Iron Mountain ores, and much purer than either those or the ores of Pilot Knob.

At Buford Mountain the ore is rich in both iron and manganese, and is likely to prove a very valuable material for the manufacture of spiegeleisen, now so extensively used in the Bessemer process.

The specular ores in sandstone differ from those in porphyry chiefly in their tendency to change, on exposure to atmospheric influences, into brown and yellow limonites and red hematites: rarely into spathic ore. Generally these deposits are of a lenticular shape, with circular or elliptical outlines, and may have been formed either by deposition from chalybeate waters in depressions in the sandstone, or by a gradual replacement of lenticular limestone deposits. When inclined, the beds dip with the slope of the hill.

The disturbed deposits of specular ore are of two kinds: Masses of ore which have been removed from their original position by underwashing or otherwise and deposited elsewhere in a more or less irregular manner; and the remaining portions of original deposits, from which other portions have been removed. Ore banks having the appearance of drifted deposits are numerous in the central ore district, but they have not been sufficiently opened to be satisfactorily studied.

The red hematites of the carboniferous formation differ from all the other ores of the State in that they do not occur as deposits with definite limits, lying as independent and foreign developments between and across other rocks, but form and compose in themselves regular geological strata. These iron-bearing sandstones frequently extend over large areas, with varying richness. None, however, have been sufficiently opened to make it possible to decide whether the ore was formed directly after and on the surface of the underlying sandstone, or whether it was infiltrated afterwards, gradually replacing beds of limestone or the sandstone itself as it happened to be more or less readily soluble.

The deposits of limonite occur neither in veins, nor in beds, nor as strata, nor in pockets of regular shape, but in irregular cracks and crevices on or near the surface of the various limestones. These cavities sometimes have very large dimensions both in depth and width, and are generally near the present surface of the ground. So far as opened these deposits afford a denser, harder, and richer ore in the upper part than in the lower, where it is more inclined to be light, porous, ochery and clayish. This fact and the invariably stalactic structure of the ore are proofs that the solutions from which the ore was deposited was infiltrated from above. One of the largest and most coherent of these banks is the Ford Bank in the eastern district. It extends some 1,500 by 500 feet along a low flat hill; the thickness is irregular, ranging from 10 to 30 feet.

The disturbed and drifted deposits of limonite have not been sufficiently opened to enable a judgment to be formed in regard to their character. The more important deposits in the entire list are as follows, the most of them being described at length in the report:

1. Containing more than 2,000,000 tuns of workable ore: Iron Mountain, in St. Francis county (specular ore).

2. With less than 2,000,000 tuns and more than 500,000 tuns: Pilot Knob (quartzose specular), in Iron county; Benton creek (specular in sandstone), Crawford county; and Simmons Mountain (specular in sandstone), Dent county.

3. Estimated to contain between 100,000 and 500,000 tuns: Shepherd Mountain (specular and magnetic), Iron county. Scotia No. 1, (specular and red hematite in sandstone), Iron county. Cherry Valley No. 1 (specular in sandstone), Crawford county. Laub Bank (specular in sandstone), Phelps county. Pomeroy Bank (specular in sandstone and limonite), Dent county. Iron Ridge No. 1 (specular and red hematite in sandstone), Crawford county. And the Meramee bank, (specular and red hematite in sandstone), Phelps county.

MODERN PROGRESS OF CHEMICAL INDUSTRIES IN EUROPE.

In the course of a recent lecture before the French Association for the Advancement of Science, M. Aimé Gérard gave a very interesting and instructive sketch of the rise and progress of many of the principal chemical industries of Europe. Beginning with sulphuric acid, which he regarded as a common pivot about which turn all the industries which call in chemical reactions to their aid, it was pointed out that, heated with rock or marine salt, the product gives us on one hand sulphate of soda, and on the other hydrochloric acid, in other words, the primary agents for the manufacture of soap, of glass wares, of paper stuff, of bleaching matters, of dye, etc. Heated with saltpeter, it gives nitric acid, the creative agent of the beautiful coloring matters used for dyeing silks. Again, by the aid of sulphuric acid we clean metals, purify oils, manufacture candles, and plate and gild by galvanic action. It is quite clear that it would be impossible to obtain the enormous amounts of the product now required from the limited sources of supply of forty years ago. Then native sulphur, obtained from the volcanic ground of Sicily, was burned at the top of large leaden chambers, and about 20,000 tuns sufficed for the manufacture of the sulphuric acid consumed in Europe. Now 275,000 tuns would barely meet the demand. This vast drain could not be met by the Sicilian sulphur grounds, and hence were engendered the attempts to utilize iron pyrites obtained in the French mines of Chessy, near Villefranche. These successful, the industry spread to England and Germany, and now the estimated production of Europe, of concentrated sulphuric acid from iron pyrites, is 880,000 tuns, enough to fill a canal 64 feet deep, 32 feet wide, and from 15 to 18 miles long.

In Marseilles, thousands of tuns of salt from the marshes are made into soap maker's alkali. Formerly the hydrochloric acid gas produced from the decomposition was lost and, escaping in white clouds from the chimney of the factory, brought destruction to crops and vegetation near. It was in England that the condensation of this gas was made obligatory on manufacturers, and laws were passed in Parliament to that effect, resulting in the transformation of the fumes into the yellow liquid from which decolorating chlorides, products which render valuable service in the bleaching, dyeing, and making of paper, are obtained. It is a strange fact that the importance of these secondary manufactures has greatly increased, and it is to the perfecting of the processes through which chemistry may manufacture these decolorating agents that the efforts of inventors are tending. In England, Weldon regenerates manganese, which generally serves for the transformation of hydrochloric acid into chlorine. Deacon seeks from the air itself the oxygen necessary to the transformation, and announces the production, now almost certain, of chloride of lime at $2 per 220 pounds: an immense progress, for, whenever we are able to extract readily from hydrochloric acid the chlorine it contains, we shall have furnished to textile industry a means of inexpensive bleaching, and to the paper manufacturer a mode of utilizing now waste products.

With the hydrochloric acid there is obtained sulphate of soda, and this is converted into soda and carbonate of soda. To effect this, it used to be heated to 2120° Fah., in a reverberatory furnace, mixed with zinc and charcoal. In front of the door stood two or three workmen, who, with huge iron pokers, kept up a continual agitation of the molten mass: brutal work, but now gradually disappearing. In England a rotating furnace is used, which consists of a horizontal cylinder, 16 feet long by 10 feet in diameter, on which a small steam engine impresses the movement of rotation about its axis. This is traversed from end to end by the flame from the hearth, and the matters, violently agitated, react upon each other without requiring the muscular force of man.

In the production of the potassic compounds, we probably meet with the most remarkable progress presented by the modern history of chemical industries. The ash left by wood, burnt in our fireplaces, is no other than a mixture of calcareous compounds, insoluble in water, and soluble salts of potash, among which the carbonate predominates. This mode of making potash from wood now only exists in America, Hungary, and Russia, and bids fair to become entirely extinct. The sources from which potash is now derived are, first, the sugar industry. A sugar beet of 4·4 pounds weight contains from 15 to 30 grains of potassic compounds. From the molasses, these in concentrated form are obtained. The molasses by fermentation is formed on the one hand into alcohol, which is obtained by distillation, and on the other into distiller's wash, which, evaporated and calcined, reproduces in the saline state the potash which the beet originally held fixed in its tissues; 6,000 tuns of potassic compounds, valued at $6,000,000, are thus annually obtained. But even this vast amount would not suffice for commerce, and hence we turn to a second source, sea water. In every quart there are 375 grains of marine salt (chloride of sodium) and 15 grains of chloride of potassium. Imagine, now, this sea water introduced into salt marshes, over immense areas, and left to evaporation. The salt is finally deposited in a crystaline state, and when some 3 inches thick it is gathered. Formerly the mother water, rich in potassic compounds, was drained off and wasted; but by M. Balard's refrigerating processes, the valuable potash is now extracted. The discovery of large mines of rock salt in Stassfurt, Prussian Saxony (where it was only necessary to hew out the potash mineral, the carnallite, with the pick axe, and boil it with a little water, to obtain chloride of potassium almost pure) dealt a powerful blow to the French industries; but after a ten years' contest, the latter, by the aid of improved processes, are again firmly established in commerce. From 10,000 to 12,000 tuns of potassic compound are now produced yearly at Camarque, France.

M. Gérard continues at some length regarding ammoniacal compounds, phosphates, sulphate of ammonia, etc. A few facts relative to the progress realized, by industries which make use of chemical products, will serve as a conclusion for our *resumé* of his discourse. As regards paper, it is stated that the production in 1873 was 143,000 tuns. Each Frenchman consumes annually in different forms more than 6·9 pounds of paper, and the entire amount yearly used in France would be sufficient to encircle the earth at the equator with a belt 192 feet wide.

The cultivation of wine in France covers 60,000,000 acres, Owing to the ravages of the *oidium* between 1850 and 1860. the production fell from 115 to 73 quarts per head per annum. Brief notice is made of the present trouble with the phylloxera. As regards the sugar beet industry, the yield for 1873 is stated at 495,000 tuns.

Operations of the Patent Office in 1873.

The annual report of the Commissioner of Patents, for the year ending December 31, 1873, shows the following:

Number of applications for patents during the year 1873	20,414
Number of patents issued, including reissues and designs	12,864
Number of applications for extensions of patents	278
Number of patents extended	233
Number of caveats filed during the year	3,248
Number of patents expired during the year	4,482
Number of patents allowed but not issued for want of final fee	2,783
Number of applications for registering of trademarks	534
Number of trademarks registered	492

Of the patents granted, there were to—

Citizens of the United States	12,371	
Subjects of Great Britain	341	
Subjects of France	64	
Subjects of other foreign governments	88	
		12,864

STATEMENT OF THE PATENT FUND.

Amount to the credit of the patent fund, January 1, 1873	$794,111 42
Amount of receipts during the year 1873	703,191 77
Total	1,497,303 19
From which deduct expenditures for the year 1873	691,178 98
Balance January 1, 1874	$806,124 21

A NEW Bunsen gas burner has been recently invented, which gives a heat of about 3,000° Fah. A furnace of thirty burners generates steam enough to run an engine of one and a half horse power.

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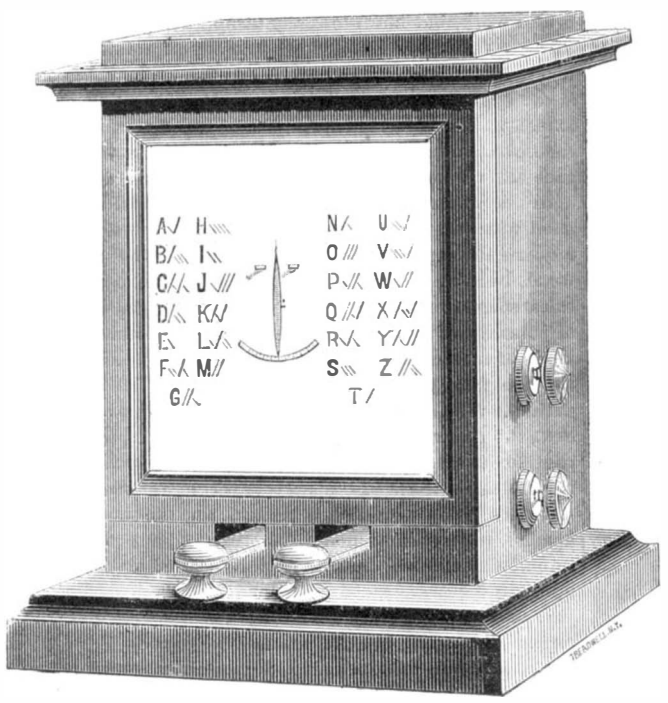
THE ENGLISH TELEGRAPHS.

The apparatus employed upon the English lines embraces almost every form which has ever been practically used, but the bulk of the traffic is performed with the Morse ink writers, the greater part of which are worked in connection with the double current key and Siemens' polarized relay. The speed of these instruments depends mainly upon the skill of the operators who work them, being generally about the same as that of the Morse recording apparatus employed upon our own lines. The speed of the Bright's bell apparatus is about the same as that of the Morse sounder, depending, like the latter, upon the skill and experience of the operators. "I timed the operator at Edinburgh," says a correspondent of the *Journal of the Telegraph*, "and found him receiving by the bells at the rate of 32 words per minute."

The Hughes type printing instruments are only used to a limited extent in England, and the speed attained is not much in excess of the Morse sounder. The instruments are carried by weights, and the type wheels make about 120 revolutions per minute, or a little more than half the speed of the Phelps combination instrument.

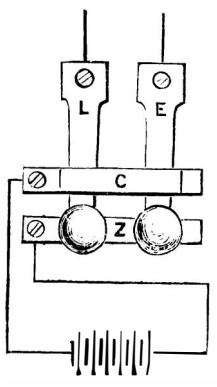
FIG. 1.



Wheatstone's automatic instruments are employed upon 33 message circuits, varying in length from 159 to 515 miles each, and upon six new circuits, varying in length from 166 to 475 miles each, making a total of about 11,000 miles.

The speed of these instruments varies from 38 words per minute upon the London and Cork circuit, to 120 words per minute upon the London and Liverpool circuit. The average speed of the apparatus is about 70 words per minute, or about twice as fast as the speed of a first class sound operator. The time occupied in the preparation of the messages for transmission depends somewhat upon the skill of the operator, but an expert clerk will easily prepare them at the rate of 25 words per minute. The automatic system, as compared with the Morse, requires rather more than double the number of clerks to do a given amount of business, and, therefore, for distances less than 200 miles, it is cheaper to put up additional wires than to make use of it.

FIG. 2.



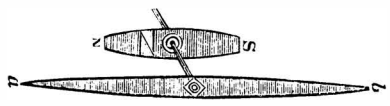
The automatic system finds its most appreciative use in forwarding press messages, which are transmitted over several circuits in succession with only one preparation.

The single needle instrument, of which there are over three thousand employed on the English lines, is one of the simplest forms of telegraph apparatus in use, being simply a combination of a vertical galvanometer or galvanoscope, and a current-reversing key.

Fig. 1 represents the exterior of the instrument. In the center of the face is suspended the index or pointer, attached to the magnet, which can deflect only a short distance to the right or left of its zero, on account of the stops. The alphabet is formed by movements of the needle or pointer to the right or left. A turn of the top point of the needle to the left indicates a dot, a turn to the right a dash. Thus A is made by a movement to the left and one to the right; H by four movements to the left.

The interior of the apparatus consists of two helices of fine silk-covered copper wire, in the middle of which is suspended a small magnetic needle, having at the end of its axis a pointer, seen on the outside face of the instrument. There is also a current, changing key, the two knobs of which protrude through the front of the instrument near the base. The key is represented in Fig. 2. L and E are two levers connected respectively with the line and with earth. When they are not depressed, they both press against the upper bar, C, which is connected with the positive pole of the battery. Either lever can be depressed so as to come in contact with the bar, Z, which is connected with the negative pole of the battery. If L is depressed, a negative current flows into the line; and if E is depressed, a positive current flows into the line. The receiving instrument at the other end of the line is so constructed that the depression of the left hand key causes a deflection of the pointer to the left; a depression of the right hand key, a deflection to the right. The needle, S N, and pointer, *a b*, are shown in Fig. 3.

FIG. 3.



The alphabet used in England contains precisely the same combinations as the Morse alphabet, but differently expressed.

THE HEBERLEIN BRAKE.

Herr Von Heberlein, Locomotive Superintendent of the Royal Bavarian States Railway, has recently invented a novel railway brake which, it seems, is eliciting considerable attention on the continent. The device, which we find described in the *Engineer*, is not a continuous brake, though it may be fitted to every vehicle in the train. The inventor prefers to divide the train into sections, including one brake car in each, and the operator in this car can apply the brake to his own coach, and to one or more others in connection with it.

The brakes are applied to the wheels by the agency of a friction pulley which engages with a friction wheel on one of the axles of the engine or of the brake car above noted. The revolution of this friction wheel winds up a flat link chain, like that of a watch, and this, pulling on a set of rods under the carriages, applies the blocks to the wheels. The pulley is of iron, but the friction wheel on the axle is built up of wooden segments, with grain radiating, and jammed between two plates set up tight with screws and nuts. The wheels of the brake car are not intended to stop running. The friction wheel instantly revolves, and its friction against the iron pulley supplies the force which applies the brake.

The mode of throwing the apparatus into action is exceedingly simple. A line extends over the roofs of the seats from end to end of the train. By pulling this cord, a detent is thrown out of gear, and the friction pulley, which is hung on a weighted bell crank lever, is suffered to fall into contact with the friction wheel on the axle, and the brake is applied as soon as the train has run far enough to wind up the slack of the chain. The cord is kept taut, so that in case a car run from the track or become detached, a strain is brought upon the line and the brakes instantly applied. Similarly also the same effect can be produced by any of the employees about the train, as readily as they can now pull the ordinary bell cord.

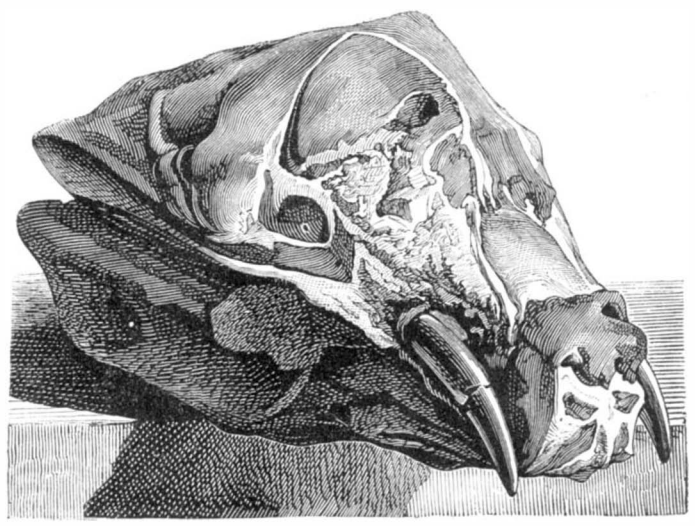
The *Engineer* says that, on trials with the invention on an English railway, no jar was apparent on the application of the brake, which was fitted to the two cars at each end of a train of five. On the first test all the brakes were applied, both to the engine and train, up an incline of 1 in 123, and round a curve, speed about 35 miles per hour; train stopped in 135 yards, and in 19 seconds. Another case is given on the Royal Hanoverian Railway, with a train weighing 76 tuns, with 17 axles, to eight of which the Heberlein apparatus was applied, when the train, traveling 35 miles per hour, was stopped on a down grade of 1 in 64 in 25 seconds.

SOUTH AFRICAN WONDERS—EXPLOSIVE DIAMONDS AND TURTLES WITH TEETH.

Diamonds liable to explode spontaneously, and turtles provided with canine teeth, are two natural marvels indigenous to the fields of Southern Africa. The former are found at the present time, the latter existed ages ago, and are recognized by their fossil remains which have been discovered in the same deposits with the gems. One of these disintegrating diamonds is represented in our first engraving in its natural size. It is a rounded octahedron, imbedded in a conglomeration of fine grained sandstone. Some idea may be gained of the richness of the South African beds from the fact, it is stated, that more than three thousand diamonds have been found during the past eight months. The mines are of two distinct kinds; the first, called "dry," are located in the centers of plains, and consist of layers of rock, in which the precious stones are mingled with garnets, pyrites, etc.; the others, termed "river mines," are established on the beds or banks of water courses, and the diamonds in these are mixed with agates, emeralds, and chalcedony. In both, however, the gems are rarely found other than in a fragmentary state, and this is ascribed to the strange peculiarity of the finest and largest stones in suddenly disintegrating or exploding. Ordinarily rupture takes place during the first week after the diamond is brought to light, but cases are known where it has occurred three months subsequently. It is said that covering the stone with tallow will prevent the trouble; but of course, if the grease has to remain permanently upon the diamond to preserve it, its value is destroyed.

EXPLOSIVE DIAMOND, IN ITS NATIVE SANDSTONE.

Although the geological age of the African diamond fields has not been absolutely fixed, it is generally believed that they date from the triassic epoch. In the strata are found the remains of crocodiles, denosaurians, labyrinthodontes, and other monsters of antiquity, but the most interesting and curious are those referred to in the beginning of this article. The skull, from which our engraving was made, strongly resembles that of the turtle, but it has two long tusks analogous to those of the walrus. Professor Richard Owens, who has profoundly studied this remarkable fossil, believes that the animals, or *dicynodontes* (the name is derived from the Greek, and means literally two dog's teeth), were, when living, oviparous, cold blooded, and yet with pulmonary respiration; and he also recognises peculiarities which ally them closely to the lizard family. Huxley is of opinion that they were provided with long tails. The peculiar genus to which the reptile, the remains of which our engraving represents, belongs is termed *ptychognatus*, and the species, *depressus*. The bones are not perfectly preserved, and were found in hard sandstone of fine grain and greenish color. In the lower jaw two cavities are noticeable, resembling incisive alveolæ which may be really rudimentary teeth.



FOSSIL SKULL OF A TURTLE WITH TEETH.

The characteristics of the animal are remarkable from the fact that they seem borrowed from those of creatures most widely separated in Nature. As a whole, the bones indicate a reptile between the lizard and tortoise. That is, the forward portion of the head resembles that of the former; and the edges of the edentulated jaws, covered during life with a bony covering like a beak, relate to the latter. The oblique manner of opening the mouth recalls the same peculiarity in certain fish. Huxley, on the other hand, asserts that the nostrils and various points in the osteology are those of birds. The tusks are more analogous to the teeth of mammifers, while the sutures of the skull resemble those of the latter, and are never met with in the case of reptiles.

Sunday Science.

There exists in Switzerland a "Society for the Observance of the Repose of Sunday" (*literatim*), and this body invites the views of the world generally on the subject of resting on the Sabbath, considered from a hygienic point of view. A prize of two hundred dollars is offered to the author of the best essay on the question. The points requiring especial discussion are: (1) The favorable effects of rest on Sunday on people of various ages, and their influence on the family and the nation. (2) Diseases which may be engendered or increased by continuous work in persons who, by the nature of their calling, are deprived of this weekly recreation, as, for instance, railroad employees, journalists, telegraph operators, bakers, etc. (3) Practical results drawn from the observation of cited facts. The essays must be written in French or German, and sent in, before September 30th next, to the President of the above named society, at Geneva, Switzerland.

THE NEW AUSTRIAN ATHENÆUM.—An institution destined to survive the Vienna Exposition, and at the same time to serve as a memorial of that event, is the Austrian Athenæum, an establishment founded in the interest and for the instruction of mechanics and working men, and constructed after the plan of the *Conservatoire des Arts et Métiers*, in Paris. Large numbers of articles left by exhibitors at the Exposition have been transported thither, together with a quantity of models and other instructive apparatus, and a library of 3,412 volumes.

MORE valuable and practical information is furnished to the readers of the SCIENTIFIC AMERICAN, through the correspondence columns of this paper, than can be obtained from any other source.

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THE SIAMESE TWINS.

The autopsy on the bodies of the Siamese twins has, at last, been consented to by the relatives, and the remains have been transported to Philadelphia. A commission, consisting of Drs. Pancoast, Allen, and Andrews, recently visited the place of residence of the twins, and, after considerable persuasion, succeeded in overcoming the scruples of the two families. The bodies, which had been deposited in cases packed with charcoal, were removed from their temporary sepulcher and carefully examined. Slight change had taken place in their appearance; but as the rapid setting-in of decomposition was feared, the physicians decided to postpone operations until the remains could be taken to Philadelphia, where every facility for a thorough investigation would be at hand. A number of photographic views were accordingly taken, after which a partial embalment was completed, when the bodies were packed into an airtight tin chest and forwarded to their destination. At the time of writing the dissection has not been completed, and public curiosity, now fully aroused regarding the matter, will look with much interest for the forthcoming report. The main question to be decided will be settled as soon as the knife severs the connecting ligature Opinion now inclines principally to the belief that the strange band contains a large artery and many veins, which made the circulation in both bodies identical. This was the view held by many eminent British surgeons, Sir Benjamin Brodie among the number, and appears to be substantiated by the fact of a compression of the ligature causing the fainting of the weaker brother. On the other side is no less an authority than Nélaton, the great French surgeon, who always maintained that separation could be safely effected, while the family physicians of the twins consider that the circulation in either body was entirely independent from that in the other. The post mortem, in deciding this interesting point, will also necessarily determine whether Eng died from the shock due to the realization of his brother's death, or from a cessation of the flow of his blood.

The illustration which we give herewith conveys an excellent idea of the appearance of these remarkable people. They were of decidedly ugly faces—our picture rather flatters them—and were far from amiable in temperament. Eng was the smaller, and generally stood in the peculiar position represented, bent somewhat backward. The details of their early history are somewhat meager. It is said they belonged to a low order of peasantry, and were born in Siam in 1811. Captain Abel Coffin, of Newburyport, Mass., found them in the city of Meklong, and bought them from their mother. In 1850 Barnum brought them before the world, since which time they have been exhibited throughout this country and Europe. Their subsequent history we have already sketched in a previous notice of their death.

THE SIAMESE TWINS.

How to Keep a Situation.

An observing correspondent in the *Western Rural* gives the following hints on the above subject:

Be ready to throw in an odd half hour or an hour's time when it will be an accommodation, and don't seem to make a merit of it. Do it heartily. Though not a word be said, your employer will make a note of it. Make yourself indispensable to him, and he will lose many of the opposite kind before he will part with you.

Those young men who watch the clock to see the very second their working hour is up—who leave, no matter what state the work may be in, at precisely the instant—who calculate the extra amount they can slight their work, and yet not get reproved—who are lavish of their employer's goods—will always be the first to receive notice, when times are dull, that their services are no longer required.

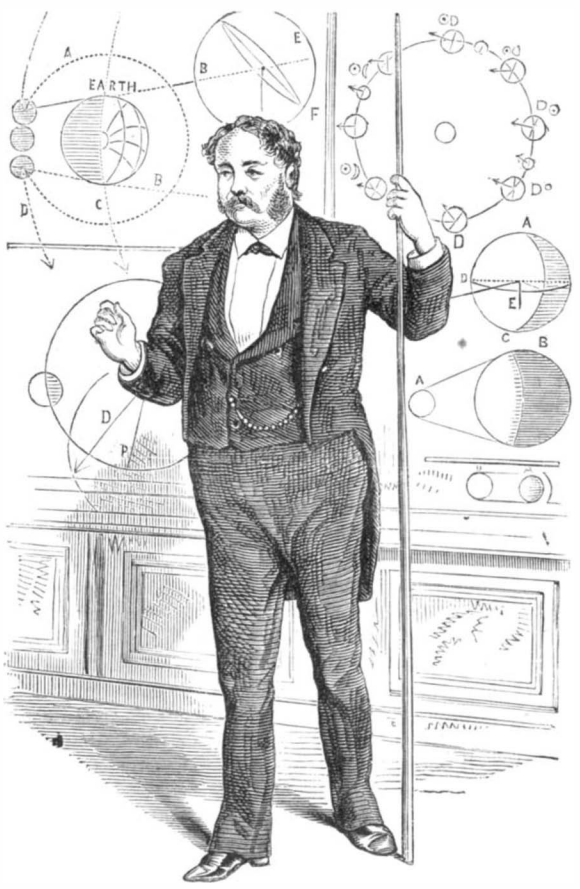
The Telephon.

This instrument, popularly known as the "steam jackass," is the invention of a farmer in Illinois. This gentleman was the owner of a mule possessed of unusual ability for producing sweet sounds, it having been ascertained that his voice could be heard over a circle of eight miles diameter. The mule was killed, and the inventor severed the head from the body. The head was then carefully preserved from decay, and the inner organs were covered with a substance that was impervious to steam. We are indebted to the Brooklyn *Eagle* for a description of the first trial of the invention

"A short piece of rubber hose was attached to the windpipe and connected with a steam boiler. It was a moment of agony to the inventor, as he placed the head in the hands of an assistant and slowly pulled the valve open, a moment of thrilling interest; as the steam was turned on, it passed into the windpipe, expelling the air and producing a sigh followed by a groan, a snort, a chuckle, then a violent coughing and sneezing. As a full head of steam was turned on, the most fearful noise, the most frightful guffaw, the most vociferous bray, that ever assailed mortal ears was produced. The lips were contracted, disclosing a terrible array of teeth; the features developed a satanic grin, and the jaws rose and fell as the steam crowded the passages; and the ears participated in the general movement, giving to the head an excited and animated appearance. The man who was holding the head gazed upon it a moment with dilated eyes, colorless cheeks, knocking knees and protruding tongue; then, suddenly losing all interest in the performance, he emigrated. As for the inventor, his success exceeded his most sanguine expectations. For an instant he contemplated the head, his countenance working with every manifestation of intense delight; then he, too, started, probably to learn the greatest distance to which that voice would penetrate."

PROFESSOR R. A. PROCTOR.

There are few instances on record of a man attaining so distinguished and, withal, so well earned a reputation, in so



short a period of time, as that of the eminent astronomer who has recently delighted the public of this city with his admirable lectures on the wonders of the heavens. Professor Proctor is now in the thirty-seventh year of his age; and although he gained honors in his collegiate course, and attracted some attention by literary efforts as early as 1863, it was not until 1865 that he definitely adopted the profession in which he is now universally admitted to be one of the ablest masters. To his celebrated controversy with the English Astronomer Royal, regarding the proper method of observing the coming transit of Venus, ending in the virtual defeat of the latter, and the subsequent corroboration of Professor Proctor's views by the first American, Russian, and German astronomers, we have already found occasion to allude; and with his published works, the clearest popular expositions of modern knowledge regarding the constitution of the celestial bodies extant, we presume our readers to be already familiar. His books are a remarkable combination of lucid and vigorous expression with scientific accuracy; and while never superficial, their subjects are treated. even when most abstract and uninviting, in a semi-imaginative manner, which lends to them a charming freshness and interest.

Professor Proctor's most recent work is a collection of essays on topics more of a general than of a purely scientific interest. Lack of space at present at our disposal prevents our here alluding to the "Border Land of Science" in such detail as we could wish, and hence we reserve its review for a more fitting opportunity. We may remark, however, that the author undertakes, in its pages, voyages to the sun and to Saturn, tells about life in Mars, and even ventures into the shadowy realms of ghosts, only, however, to demolish those vagaries of the brain, by the bright light of scientific investigation and logical deductions of cause and effect.

Professor Proctor is of genial and pleasant appearance, and is a fluent and ready speaker. His lectures are excellent even as literary efforts; and although in some instances technically above the ordinary scientific discourse as usually adapted to the comprehension of a general audience, they nevertheless are so agreeably delivered and so brilliantly illustrated, that the interest of his hearers is kept constantly alive from beginning to close. An artist contributes a sketch as he appears upon the platform.

To Destroy Insects.

Hot alum water is a recent suggestion as an insecticide. It will destroy red and black ants, cockroaches, spiders, chintz bugs, and all the crawling pests which infest our houses. Take two pounds of alum and dissolve it in three or four quarts of boiling water; let it stand on the fire until the alum disappears; then apply it with a brush, while nearly boiling hot, to every joint and crevice in your closets, bedsteads, pantry shelves, and the like. Brush the crevices in the floor of the skirting or mop boards, if you suspect that they harbor vermin. If, in whitewashing a ceiling, plenty of alum is added to the lime, it will also serve to keep insects at a distance. Cockroaches will flee the paint which has been washed in cool alum water. Sugar barrels and boxes can be freed from ants by drawing a wide chalk mark just round the edge of the top of them. The mark must be unbroken or they will creep over it, but a continuous chalk line half an inch in width will set their depredations at nought. Powdered alum or borax will keep the chintz bug at a respectable distance, and travelers should always carry a package of it in their hand bags, to scatter over and under their pillows, in places where they have reason to suspect the presence of such bedfellows.

The Taylor Steam and Hydraulic Cotton Press.

About a year ago, we illustrated an improved form of steam and hydrostatic cotton press, the invention of Mr. John F. Taylor, of the Phœnix Iron Works, Charleston, S. C., and in the accompanying description, page 15, volume XXVIII, the reader will find a full explanation of its working. The power is transmitted to the oil, water, or other liquid in the press from the pistons of two steam cylinders, which act upon the plate alternately, one imparting the initial and the other the finishing pressure. The latter is operated by live steam from the boiler, and the former is actuated by the exhaust. The steam is thus used twice over, on the compound principle, thus effecting no inconsiderable saving of fuel.

One of these machines has recently been erected in the warehouse of Mr. E. C. Pentz, foot of West 11th street, in this city, where it is now in operation re-pressing cotton for shipment. The motion of the apparatus is uniform and entirely free from jar, and its capabilities are stated as extending to the pressing of 100 bales of cottton per hour. The inventor submits testimonials to the effect that 700 bales have been pressed in a working day of ten hours. The power of the machine is 2,006,400 lbs. under 80 lbs. of steam. A continuous and steady pressure, we understand the inventor to assert, is maintained so long as steam is kept up in the boiler. The construction is strong and simple, and there appears to be a notable absence of pumps, valves, and other portions liable to be quickly worn out.

THE sand blast is said to work well in cleaning the walls of iron and stone buildings.

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Geographical Progress in 1873.

Judge Daly, in an able address before the American Geographical Society in this city, of which he is the President, recently reviewed the progress of explorations and other efforts toward increasing our geographical knowledge, made during the year just ended. The lecture was an exhaustive review of the whole subject and a summing up of the results obtained. The utility of geographical societies as organized means of promoting geographical discovery, as well as the necessity for their existence, is proved from the fact that there is yet one seventeenth part of the globe of which we know nothing except by conjecture.

The region which surrounds the south pole, the antartic, covers an area of 7,000,000 of square miles. The arctic measures nearly 3,000,000. The unexplored portion of Africa may be put down at least as 1,000,000. The unknown part of Australia is certainly more than two thirds of that amount; and in this connection, attention may be drawn to the great islands of the East Indian Archipelago, stretching from the northeast corner of Asia to New Zealand, occupying the most favored part of the earth, and which have in extent the magnitude of a continent. One of this great group, Borneo, is considered the second largest island on the globe. A strip along the coast of about 100 miles deep represents what we know of it; the interior and larger portion remains unknown. So also of Papua or New Guinea, which is as large and may even be larger than Borneo. Sumatra is 1,000 miles in length, and Celebes and Luzon are inferior only to Sumatra; and there are in addition numerous islands of considerable size, some as large as Ceylon, and thousands of minute islands, many abounding in spices and mineral ores.

Regarding recent

ARCHÆOLOGICAL DISCOVERIES,

the speaker stated that late excavations made in Rome have revealed that the ancient city, before the Republic, in the time of the kings, was large and strongly fortified, and must have contained an immense population. This is contrary to the impressions of modern historical critics. The foundations of the ancient city have been laid open, which consist of enormous works, many of which were great tanks and wells. The foundations are constructed of oblong blocks of tufa, put together without mortar, the style of building being the same as found in the ruins of Etrurian cities.

Dr. H. Schlieman terminated his excavations upon the supposed site of Troy last summer. He thinks that he has discovered Skaean gate, Priam's palace, and the great wall described by Homer. He writes of his discovery of a great wooden box containing jewels, precious stones, ornaments, and arms, such as battle axes, shields, and an immense goblet of pure gold, with two handles and two mouths, which box, he says, has disappeared. In the island of Delos a whole temple has been laid bare and the ruins of a whole city discovered, and additional excavations, attended with important discoveries, have been made in Pompeii.

A stone has been found on a farm in Parahyba in Brazil containing an inscription, which, upon examination, was found to be in Phœnician characters, which would prove that the Phœnicians had visited America at a very early period.

After fully referring to the various surveying expeditions in Central and South America,

ASIAN EXPLORATIONS

were noted, and it was stated that the Russian campaign which culminated in the capture of Khiva has produced valuable geographical results. The most important information of changes is the addition of the right bank of the Oxus to the Russian dominions, embracing the country north of that river, east of the Sea of Aral. Forty thousand slaves have been liberated in the conquered territory, and slavery has been abolished for ever.

Mr. Jacob Halevy has explored the southern part of the Arabian Peninsula, through the interior of Yemen, a country little known and where traveling is perilous. His journey extended from Hodegeda, on the Red Sea, in a northerly direction, through the Wadi Flabouna, 18° 55′ north latitude.

In this part of the country he found many Sabœan inscriptions, and saw the source of the River Kharid, which runs toward the interior of Arabia and disappears, after fertilizing the numerous oases of the Djaouf. He believes this to be the river which is alluded to in a passage of Strabo as having been crossed by a Roman army, Aelius Gallus, before entering the country of the Sabœans. Innumerable ruins in a crumbling condition, he says, cover the soil on the banks of the Kharid and its affluent, the Medheb.

THE ANCIENT JERUSALEM.

Concerning the explorations in Jerusalem, the speaker said:

The details of this work, which occupied nearly three years, are too numerous to enter upon; shafts were sunk below the present city in various places to a considerable depth, and discoveries were made of extensive subterranean passages and galleries, winding aqueducts and canals which were cut in the solid rock, chambers, drains, sewers, wells, and tanks. A stream of running water was found, showing that fountains exist far below the surface, and are still running, a circumstance of interest, as there is now a dearth of water in Jerusalem. Inscriptions in the Phœnician characters in red paint were found upon walls, and many objects of interest were gathered, such as lamps, pottery, weights, seals, gems, and sepulchral chests, some of them very beautiful, containing human remains. An attempt was made to determine the exact position of parts of the Temple and the site of Solomon's palace; but while the investigations have had the effect of disturbing many of the previous theories as to the precise locality of places, they have not been sufficiently certain to remove doubts, or dispense with further inquiry.

THE PENINSULA OF SINAI

has been surveyed by Professor Palmer and Dr. Drake, and they conclude the locality to be the scene of the events recorded in the history of the Exodus, and its examination has certainly furnished a remarkable corroboration of the truthfulness and accuracy of the Biblical history. The country is extremely wild and rugged, and has one of the most complicated systems of drainage in the world. Formerly it was well wooded, its mountain sides terraced with gardens; its rushing waters regulated and utilized; and this fertility lasted until comparatively modern times. Jebel Musa is considered to be undoubtedly the Mount whence the Law was delivered.

PALESTINE.

The country lying east of the Jordan and of the Dead Sea has been undertaken by the American Palestine Exploration Society. It embraces the part of Palestine which is the least known, and is in territorial extent three times as great as the country surveyed by the English. It abounds in ruins, inscriptions and objects of great interest, and its exploration will undoubtedly throw a great deal of light, not only upon Biblical history but upon the former history of the whole country lying midway between Ancient Assyria and Egypt.

Lieutenant Steever has spent about five months in explorations east of the Jordan. He has surveyed about 600 square miles, and has prepared a very valuable map. The explorations were in Edom and Moab. Various sites have been satisfactorily identified, and the positions of Mounts Nebo and Pisgah determined. The levels of many important spots were taken, a number of ruins in Moab examined, and interesting inscriptions copied.

AFRICAN EXPLORATIONS

are represented to be less fruitful in positive results than those of former years.

MM. Compeigne and Marche have undertaken to penetrate Equatorial Africa in the vicinity of the Gaboon. Their object was to trace the course of the Ogoone and the lakes to which it is supposed to lead, one of which is reported to be very large. The last accounts of Dr. Gandy, the commander of the West African Livingstone Exposition, are that he left San Salvador, the farthest point in the Portuguese dominions, for the country east, which is nearly a blank upon our maps. A German expedition, organized by Dr. Bastian and the Berlin Geographical Society, left last spring for the exploration of Loango.

With a glance at the reports of exploring expeditions in Australasia, Judge Daly concluded his survey with a reference to the telegraphic event of the year, which he thinks has been the completion of a line of telegraph across the entire length of Australia, from south to north, from Adelaide in the south to Port Darwin in the north, a distance of 2,012 miles.

The completion of the telegraph across Australia gives a line, from Adelaide to Gibraltar, of 12,462 miles, of which 9,146 miles are submarine. The practical result is that Australia now receives news three weeks earlier than the latest brought by the mail steamers.

Correspondence.

Air Poison and its Remedy.

To the Editor of the Scientific American:

The effects of fresh air upon the human system are well known to be renewed strength, increased vital force, and hightened complexion; while the fetid atmosphere of close rooms produces pallor, weakness, and diminution of the mental capacity. It is remarkable that the same body, air, should have such diametrically opposite effects under but slightly altered conditions.

After the discovery, in the last century, of the composition of atmospheric air—which is about one fifth oxygen and four fifths nitrogen—it was ignorantly believed to be the absorption of oxygen by breathing, and consequent relative increase of nitrogen, that made the air of crowded rooms noxious; but analysis abolished this idea, and proved that the relative proportions of the two gases are always the same. The oxidation of the carbon supplied by our food causes the gas exhaled from the human frame to be largely composed of carbonic acid; but the chief impurities of the air, which cause decay and putrefaction of organic matter, are the living vibrios, which multiply so rapidly that, were it not for the eternal compensation of natural forces, they would soon suffocate all other life off the earth. Their fell enemy is ozone, which is oxygen in a negatively electric state, and exists in our atmosphere in a proportion varying from one ten-thousandth to one one-hundred-thousandth. Ozone is generated by lightning flashes, which have been truly said, from time immemorial, to clear the air. The evaporation of saline solutions also disengages ozone, which is always found in increased proportion on and near the sea. Being more dense, and one and a half times more heavy, than oxygen, it descends to the earth, from which the vibrios ascend. It has also a strong phosphoric smell, and has the important property of combining with all bodies, except gold, platinum, and water. This property is its great weapon in the destruction of the vibrios.

The open air is the space in which ozone continually rules, while the vibrios have the supremacy in close and fetid places where ozone is very seldom or never recognized. Every breath we take in such places begins to poison and to weaken our system, while every breath in the open air neutralizes poisonous agents and renews strength. D.

The Aboriginal Americans.

To the Editor of the Scientific American:

There is, I think, abundant evidence that the osseous structure of the mound-building aboriginal peoples differed, to some extent, from that of all the present inhabitants of the globe, after making due allowance for individual peculiarities.

In my researches in this country, which was at one period densely populated by the mound builders, I have never seen anything resembling the short, strong bone running from the sixth cervical vertebra to the scapula, mentioned by Mr. R. K. Slosson, on page 244 of your volume XXVIII., and am inclined to look upon such a bone (if found) as a *lusus naturæ;* but I have found several bones that I am unable to classify or pronounce upon, among which are the submaxillaries, of which I wrote you some time since.

I have a genuine mound builder's skull, which, although somewhat decayed, is a marvel to all who behold it and contrast it with what we know of modern man. There are marks on the skull caused by the copper ornaments with which this once noted character (for such he undoubtedly was) was buried. The man who stood under that skull was probably a stranger to disease, and knew no such thing as fear. A rifle ball would hardly fracture or enter his head, if it were to strike it in any way but perpendicularly. There is a peculiar formation where the muscles of the neck were attached, such as none of us ever saw before. This skull is an object of deep interest, and most especially would I call the attention of all phrenologists to a specimen so rare. The copper crown, with which his head was discolored, was so far decomposed that I was unable to save it.

Yellowbird, O. S. L. N. FOOTE, M.D.

Glue as a Healing Remedy.

To the Editor of the Scientific American:

For the last twelve or fourteen years I have been employed in a shop where there are over three hundred men at work; and, as is the case in all shops of this kind, hardly a day passes but one or more of us cut or bruise our limbs. At first there were but few that found their way to my department to have their wounds bound up; but after a while, it became generally known that a rag glued on a flesh wound was not only a speedy curative, but a formidable protection against further injury. I was soon obliged to keep a supply of rags on hand, to be ready for any emergency. I will here cite one among many of the cases cured with glue.

A man was running a boring machine, with an inch and a quarter auger attached; by some means, the sleeve of his shirt caught in the auger, bringing his wrist in contact with the bit, tearing the flesh among the muscles in a frightful manner. He was conducted to my department (the pattern shop), and I washed the wound in warm water, and glued around it a cloth, which, when dry, shrunk into a rounded shape, holding the wound tight and firm. Once or twice a week, for three or four weeks, I dressed the wound afresh, and it was well. The man never lost an hour's time in consequence. The truth of this statement hundreds can testify to. I use, of course, the best quality of glue.

Racine, Wis. J. A. FIELD.

The Hartford Steam Boiler Inspection and Insurance Company.

This company's report for 1873 has recently been received. It is an unusually interesting and important paper, and the brief summary that we give below does but scant justice to its merits.

Inspections in 1873: Internal, 8,511; external, 23,312—total, 31,823.

Defects discovered: Furnaces out of shape, 599; cases of fracture, 1,003; burned plates, 682; blistered plates, 1,737; cases of deposit of sediment, 2,263; cases of incrustation and scale, 2,180; external corrosion, 818; internal corrosion, 333; internal grooving, 206; defective water gages, 561; defective blow-out apparatus, 253; defective or overloaded safety valves, 321; defective pressure gages, 1,470; boilers without gages, 682; cases of deficiency of water, 113; cases of loose and broken braces and stays, and insufficient bracing, 465—total, 13,866.

Boilers condemned in 1873, 178.

Boiler explosions in the United States in 1873, 88; number of persons killed, 139; number of persons wounded, 164.

Cases of distortion and fracture of furnace sheets occur from low water, deposits of sediment, and a cold water feed. It is economy to heat the feed water, because it both saves fuel and prevents wear and tear. Sheets are liable to be fractured, if boilers are blown down when heated. Blisters in plates occur from the use of iron which is not homogeneous. Blisters should be cut off; and if the thickness of the plates is much reduced, patches should be put on. The deposit of sediment gives the most trouble to steam users. When the feed water contains carbonate of lime, it will be deposited in a hard mass, if the boiler is blown down when hot; but it can be washed out, if the boiler is first allowed to cool. Grease in the boilers seems to combine with the carbonate of lime, and sink down upon the plates, keeping the water from them and causing overheating and burning. Feed water heaters, with separating plates or chambers, seem to work well when the water holds solid substances in solution. The deposits of sulphate of lime are the mos

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troublesome. Potatoes and slippery elm seem to prevent and remove scale in many cases. Substances containing tannic acid also seem serviceable with some kinds of water. There should be frequent blowing off when these solvents are used. Crude petroleum seems to prevent scale when the water is principally impregnated with sulphate of lime, but is not recommended where the carbonate of lime is the principal foreign ingredient.

External corrosion is frequently caused by the exposure of boilers to the weather, and by leakage and dripping. It is a bad practice to put ashes on top of the boiler, wood ashes being the most liable to produce corrosion. Coatings of felt or calcined plaster can be used with benefit. Ashes are frequently allowed to accumulate in the ash pits of boilers, and, becoming wet, produce corrosion.

Internal corrosion is caused by scale, or by acid in the water. If the latter occasions the trouble, the surest remedy will be to abandon the water and get a supply from another source. The dyes discharged from factories into streams frequently render the water unfit for use in boilers. This difficulty can sometimes be remedied by neutralizing the acid by the use of soda or soda ash. It should be remarked, however, that all the solvents and neutralizers mentioned above should be used with great caution, as their indiscriminate application is frequently productive of more harm than good.

Internal grooving or channeling probably arises from unequal expansion and contraction, in connection with the use of impure feed water. Glass gages are sometimes stopped up by a mixture of grease with the impurities of the water. The lever safety valve is most commonly used, and, under the care of a competent and reliable man, is all that is needed. It should, if possible, be so arranged that it cannot be tampered with. It should be raised every day, in order to prevent corrosion and sticking to the seat. Pressure gages should be tested every few months. The hight of the water in a boiler should always be ascertained before starting the fire. It is not unusual to look after the fire first and the water afterward; and in many cases, boilers have been nearly ruined from this cause.

Many boilers are braced imperfectly, or not at all. Boilers are frequently left without examination for months, and the bracing becomes defective. Steam users take too many chances, under the advice of boiler makers who are ignorant or careless.

The above will be sufficient to show that there is no need of mysterious theories to account for boiler explosions. Boilers, with the best of care, will wear out, and the process is much hastened if they are improperly set and badly managed.

The Company employs about 30 inspectors, who inspect the boilers under their care quarterly and semi-annually. Defects, when discovered, are pointed out; and unless they are repaired, the Company's liability ceases.

SCIENTIFIC AND PRACTICAL INFORMATION.

ADULTERATIONS IN YELLOW AND RED CHROMES.

The yellow and red chromates of lead, employed as pigments, frequently contain sulphate of lead. This substance is insoluble in strong nitric acid, and in this way it can be detected; but a neater and more convenient method, proposed by Dr. Julius Löwe, consists in the use of hyposulphite of soda. The finely pulverized pigment is placed in a moderately concentrated, cold solution of pure hyposulphite of soda, when the sulphate of lead readily dissolves, leaving the chromate unacted upon. After filtering, the filtrate may be tested for lead by adding a solution of the neutral chromate of potash, when the yellow chromate of lead will be precipitated. If it is desired to ascertain the amount of the sulphate of lead present, it may be precipitated by sulphuretted hydrogen gas, or by sulphide of ammonium, as sulphide of lead, which is then purified and converted into sulphate of lead by the use of fuming nitric acid, and weighed. This method is preferable to the one depending on the insolubility of sulphate of lead in nitric acid, as proposed by E. Duvillier recently, since there might be other insoluble adulterations present, as, for example, barytes.

THE DETECTION OF BLOOD SPOTS.

M. Sonnenschein states that tungstate of soda, strongly acidulated with acetic or phosphoric acid, throws down albuminoid matters from very dilute solutions. These precipitates, insoluble in a large excess of water, dissolve in alkalies, especially if hot. If defibrinated blood is treated with this salt, a red brown precipitate is formed, which becomes clotty on boiling. All the coloring matter is precipitated. To detect blood spots by this means on clothing, the suspected portion is cut off; and after having been treated with distilled water, the filtered solution is precipitated with the above reagent. The precipitate, washed and treated with ammonia, takes a reddish grey color. If phosphoric acid be present, it must be carefully washed away before treating the precipitate with ammonia.

THE TELEGRAPH IN CHINA.

The Great Northern Telegraphic Company has recently established a line between Woosing and Shanghai. Twenty words are sent for a dollar. This is the first successful attempt to introduce the telegraph through the main portion of the empire, as previous efforts have been met with violent opposition from the people, who cut the wires and destroyed the poles.

NITRITE OF AMMONIA.

M. Berthelot has recently succeeded in producing this body for the first time in a crystaline state. Nitrite of baryta is placed in sulphate of ammonia. The precipitated sulphate of baryta is collected on a filter, leaving the nitrite of ammonia in solution in the liquid. The crystalization of the latter cannot be obtained by heat, as the same causes a rapid decomposition of the substance; hence the liquid is placed under the receiver of an air pump, with very hygroscopic materials. In spite of these precautions, however, and although the operation is conducted at the freezing temperature, about two thirds of the product become decomposed. The balance, however, is pure nitrite of ammonia, crystalized in white needles. The body is remarkable for its explosive properties, detonating violently at 165·2° Fah., or by reason of a shock, with a force nearly equal to that of nitro-glycerin.

A CIRCULAR COMPASS NEEDLE.

M. E. Duchemer has addressed a note to the French Academy, in which he claims that a circular compass needle possesses the following advantages over the usual form:

1. A magnetic power, for a given diameter, double that of a needle whose length is equal to this diameter.

2. The existence of two neutral points instead of one, which has the effect of maintaining the position of the two poles constant; the magnetism seems to be so energetically preserved that even the strongest sparks of a Holtz machine do not cause any displacement of the poles of the magnet.

3. A more satisfactory means of suspending the magnet when it is well mounted and balanced by a plate of agate; it seems then to move as if placed in a liquid.

4. An increase in sensibility of the magnet proportional to its diameter.

5. The possibility of neutralizing the magnetism of the vessel by means of a second magnetic circle, changing the position by an amount calculated beforehand, and thus permitting the compensation of the compass before the sailing of the vessel. This idea was suggested by Captain D. Venie.—*Comptes Rendus.*

NEW EXPERIMENTS IN CONVECTION.

The phenomenon of convection of heat in a liquid, consisting in that the superior portion of the mass is always at a more elevated temperature than the lower part, can be clearly illustrated by the following novel experiments:

Two glass tanks are placed before a white surface; one is filled with cold and the other with boiling water. A solution of starch is freshly prepared in a large test tube, and, by the addition of an aqueous solution of iodine, colored a deep blue. The liquid is then warmed until this color just disappears, care of course being taken not to add an excess of iodine, which would prevent this action; and the tube is then plunged into the cold water. The blue color, brought back by the cooling, will appear first in the lower portion of the tube, and will gradually extend upward, thus proving that it is the lower portion of a warmed liquid which first becomes sufficiently cooled to cause a return of the tinge.

In the other tank, containing boiling water, a similar test tube, containing a blue liquid obtained by the addition in excess of caustic potash to a solution of sulphate of copper and tartaric acid, to which a little grape sugar is added, is placed. The formation of yellow oxide of copper begins at the surface of the liquid and descends gradually to the lower portions, showing that it is the upper part which first attains the temperature necessary to cause the re-action which precipitates the oxide of copper.

The Fireproof Building Company.

On January 12, a fire test was made of the Fireproof Building Company's concrete, at their works, corner of Corlears and Cherry streets in this city. Below we give the details, which will doubtless be interesting to our readers: The company had constructed a small house, and a model of a mansard roof. The latter was open at the top, and was made with wooden rafters, covered on both sides with the concrete blocks, the inner blocks being 1½ inches in thickness, and the outer ones, 2½ inches. The inner blocks were hollow, and the outer solid. A part of the outer covering was slated, and a small space was covered with plastic slate roofing, which consists of ground slate mixed with a residuum of coal tar until it acquires the consistency of common mortar, and is then applied with a trowel to a double layer of felting, the slate mixture having a thickness of about ¼ of an inch. This was arranged so that the edges were not exposed, being covered by the common slate. A fire was made both within and around this model, and was allowed to burn for 35 minutes. During its continuance, loud explosions occurred, caused by the hard finish breaking off from the inside of the blocks, the material not having been thoroughly dried. When the fire was extinguished, it was found that the ordinary slate had crumbled to a serious extent, while the plastic slate was uninjured. The concrete blocks were apparently unchanged.

The next test was made with the house. This was a small building about 8 feet square, and the same hight. It was built near the factory chimney, with a flue running into the chimney. The walls were 7½ inches thick, and an inside wall, also 7½ inches in thickness, was built on one side, a hole being made in the outer wall on that side, so that a thermometer could be inserted. The walls were made of solid blocks. The roof of the building was composed of wooden rafters, covered with solid blocks 4 inches thick, and having blocks, 2 inches in thickness, suspended from the bottoms of the rafters. The floor was constructed in a similar manner. A large fire was made in the house with logs soaked in oil, and was allowed to burn for 50 minutes. After the fire had been burning for 20 minutes, the inner wall had hardly become heated through. The space between the two walls was filled with steam after the fire got well under way. During this test a large block of concrete with three holes in it had a piece of wood put into one, some paper into the other, and a handful of shavings into the third. The holes were then closed with cement, and the block was thrown into the fire, a bucket of oil being also thrown in immediately afterwards. After the fire was extinguished, a workman, reaching into the building, chipped away pieces of the floor and ceiling blocks. The beams were thus exposed, and they were found to be damp and scarcely warm to the touch. The large block was broken open and its contents were found to be in a similar condition. After this test, the visitors were shown a floor, built of these blocks, and weights were put upon it to prove its strength.

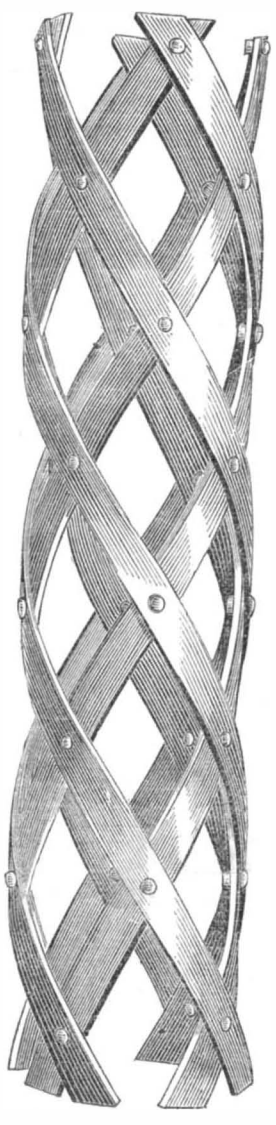
The blocks with which the foregoing experiments were made are composed of cement, consisting chiefly of the hydraulic lime of Teil, which is said to combine great strength with lightness. The blocks used for partitions have been found capable of resisting a crushing force of 800 pounds per square inch, and the weight of these blocks, 4 inches in thickness, is 11 pounds per superficial foot.

We should have stated that the fire was quickly extinguished by water at the conclusion of the tests, and that the blocks showed no signs of cracking, under this severe proof.

Those who have carefully perused the foregoing statements will see that these tests are not conclusive as to the fireproof qualities of the material. As a general rule, buildings do not take fire immediately after completion, and before the cement is dry. It would be interesting to see an experiment with this concrete after it had been thoroughly dried.

THE RIBBON POST.

The Ribbon Telegraph Post Company, of Manchester, England, have recently introduced a light and graceful form of iron pole or pillar, constructed as represented in the annexed engraving, extracted from *Iron*. The ribbons are made around a mandrel, which is provided on its exterior with spiral intersecting grooves. The latter form a receptacle for the ribbons, which are wound on by machinery, without twist or strain, and in such a manner that the gradual decrease of the pole is compensated for. The first series is put on from right to left, beginning at the bottom; the next, in the reverse direction, commencing at the top. The latter ribbons, of course, overlap, and are, at this stage of the operation, temporarily secured to those beneath them by bolts fitted in holes previously punched in both, so as to coincide exactly at the points of intersection.



The core of the mandrel is then removed, causing it to collapse, when the pole is withdrawn and placed upon a cylindrical bar, ready for the insertion of the angle irons. These, previously punched, are secured by rivets to the intersections of the ribbons, the temporary fastenings being taken out. The cap, the nature of which depends necessarily upon the uses to which the pole is to be devoted, is then put on; and the base, consisting of various forms, strengthened with extra iron and inserted, for some little distance, with the ribbon and secured to a plate which affords a strong support, is added.

The strength of poles thus constructed is said to be very great. Two, without angle irons, measuring 10 feet by 8 inches, supported a weight of 10 tuns without sinkage, deflection, or collapse. The total weight of a telegraph post 31 feet long is about 434 pounds.

On rocky ground, these posts can be fastened directly to the surface of the rock; no lightning conductor or earth wire is required, since the poles are themselves conductors; no ladders are needed; they offer small resistance to the wind, and are ornamental and durable. It is suggested that they may be advantageously used as substitutes for the heavy iron pillars or clumsy wooden supports frequently employed in the construction of conservatories, porches, etc.

THE OHM.—The term "ohm" is derived from the name of the celebrated electrician who first ascertained the laws of electrical resistance, and is a measure of resistance of which it is the unit, in the same way as we use the inch or yard in the measure of length. The "ohm," as a unit of resistance, was adopted by a committee of the British Association, many years ago, and is now the acknowledged standard of resistance throughout the world. The ohm represents the resistance of about 210 feet of copper, wire No. 16, or galvanized wire No. 8, unexposed to disturbing causes and in a temperature of 60° Fah.

To pass our time in the study of the sciences has, in all ages, been reckoned one of the most dignified and happy of human occupations.—*Brougham.*

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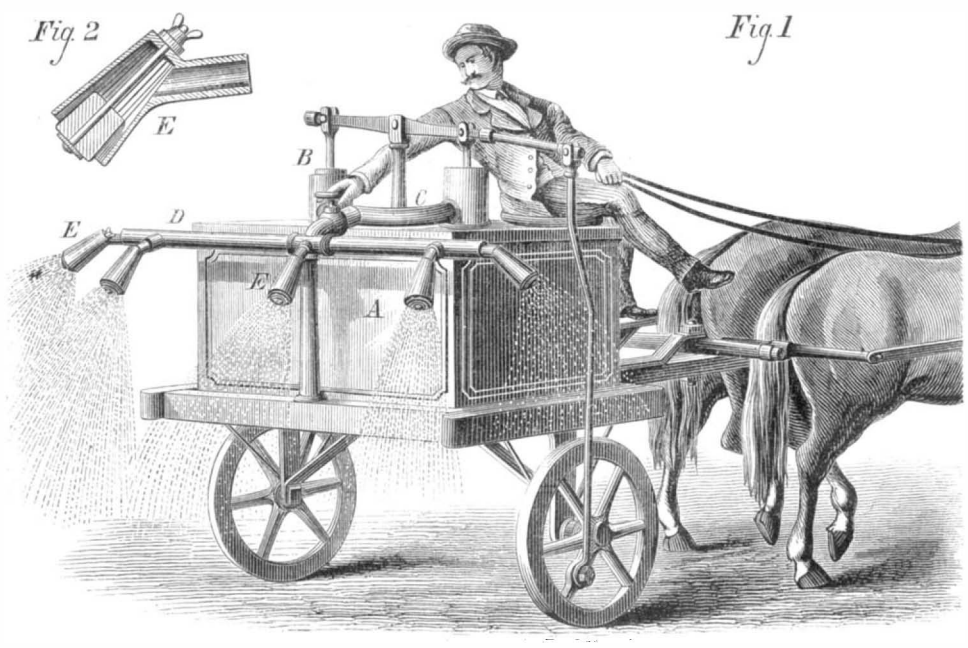
IMPROVED COTTON WORM DESTROYER.

The inventor of the device represented in our engraving proposes to exterminate cotton worms by ejecting a poisonous liquid over the plants on which they exist. To this end he has devised a novel apparatus, mounted on wheels, so as to be drawn by horses around the field, which is provided with mechanism by which the fluid is distributed in the form of a fine spray.

There is a large tank or reservoir, A, into which the poison is placed, and from which it is lifted by the double action force pump, B, into the two branches of a pipe, C, on top of the tank. The lever of the pumps is actuated, as will readily be understood from the engraving, by a pitman pivoted eccentrically on one of the wheels of the apparatus. From the pipe, C, the liquid passes through a suitable valve, by which its flow is readily governed, and into a horizontal tube, D, which runs transversely across the rear of the tank. To this tube are connected several shorter pipes, E, a section of one of which is represented in Fig. 2. In the interior of these attachments, which are of cast metal, are cut grooves, and their lower ends are closed by plugs of india rubber, which are secured by a rod and set screw. By means of the latter the stoppers can be tightened or loosened in the opening at will.

It will be seen that the liquid, being continually carried up by the force pumps, will, in passing through the lower end of the tubes, E, escape by way of the grooves, and assume the form of fine spray, which will penetrate and evenly distribute itself over the foliage of the plant. The wheels upon which the apparatus is mounted are smaller than those ordinarily used for wagons, and are attached to the tank by means of vertical bars. The machine is thus enabled to pass over the rows of plants without injuring the same; while, at the same time, the dimensions of the wheels are such as to give the required number of strokes to the pump lever necessary to the production of a constant and full volume of spray from the pipes, without auxiliary gearing. The action of the device is necessarily automatic, and hence but a single hand is needed to regulate the spray openings, admit or cut off the liquid, and guide the horse or horses attached to the machine.

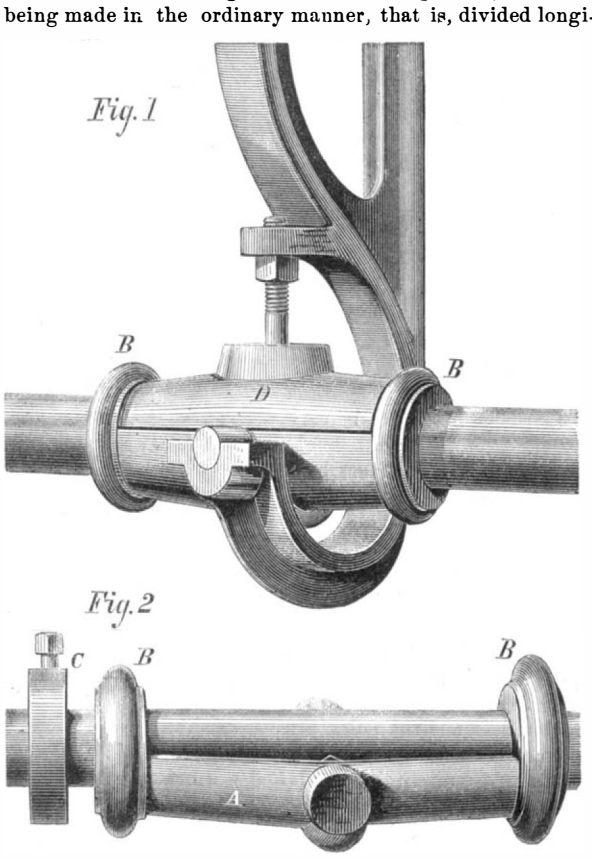
Patented December 16, 1873. For further particulars address the inventor, Hon. J. W. Johnson, Columbus, Texas.



JOHNSON'S COTTON WORM DESTROYER.

IMPROVED BEARING FOR SHAFTING.

In examining the annexed engraving, the reader will notice that the box through which the shaft passes (instead of being made in the ordinary manner, that is, divided longitudinally, and the halves united by bolts) is constructed of two portions of unequal size. The idea of the inventor is to produce a bearing, the ends of which, in taking against the usual collars or rings, secured to the shaft to prevent end motion of the box, shall not cause the unequal wear of the collars and the consequent disagreeable noise.



The lower portion of the box, A, Fig. 2, is cast hollow to fit the shaft, and in a single piece; while at its extremities rings, B, are provided to abut against the collar, C, on the shaft. These rings present a smooth surface to the collars, and hence exercise but very little wearing effect upon the same. In putting up a line of shafting, the box, A, has to be slipped over the end, the shaft passing through the rings which, of course, support the box when bearings are being fitted, and also during repairs, etc. The upper part of the box, D, fits, as shown in Fig. 1, in the opening between the rings, B, and, if both portions are made with flanges, the bearing is readily attached together by bolts in the usual way.

In our engravings, however, these flanges are omitted, and the mode of securing the box in the hanger is clearly shown in Fig. 1. Lugs are cast upon the box, A, which fit in suitable sockets in the hanger; and an indentation with raised sides is formed upon the cover, D, into which a screw, passing through a projection on the support, is, by a nut, firmly turned. It will be noticed that the apparatus, while thus held tightly in place, can, by loosening the screw, the work of a minute, be quickly opened for any purpose. In practice, the apertures in all boxes of the same size are designed to be of similar dimensions, so that all the covers may be cast alike, and hence all fit any one box. The inventor states that the difficulty often met with in losing line by taking off the ordinary boxes and then replacing them accidentally end for end, as may easily be done, is here necessarily avoided, as the lower portion of the bearing is always on the shaft, unless removed over the extremity. The interior of the box is lined with the usual Babbitt or other suitable metal.

Patented December 16, 1873. For further particulars, address Messrs. Pierre J. Hardy & Co., 156 West 19th street, New York city.

Manganate of Baryta as a Green Pigment.

The manganate of baryta, possessing a handsome green color, has attracted the attention of color manufacturers; and it has been proposed to employ it as a pigment. Two methods of preparing it have been published: One consists in igniting together the nitrate of baryta and manganese oxide or dioxide; the other consists in fusing a mixture of of pyrolusite or black oxide of manganese, caustic baryta, and chlorate of potash. By either process a green mass is obtained, but the second method seems to yield a more beautiful and homogeneous product. In experimenting with other and more direct methods for preparing a baryta green of great purity and beauty, Fleischer has made several observations of its properties not generally known, which will, we think, prove of interest to our readers.

If a green solution of manganate of potash be precipitated while boiling, by chloride of barium, a heavy, granular, but not crystaline, precipitate of manganate of barium is obtained. This precipitate has a violet color, approaching blue, can be washed by decantation at first, and afterwards may be collected on a filter. On drying the precipitate, its color grows lighter with the increase of temperature; and on being heated to a dark red heat, it looks almost perfectly white, with only a shade of grayish blue. If then it be heated still higher with free access of air, or in an oxidizing flame, it gradually turns green; by carrying the process farther, the color becomes a beautiful greenish blue, and finally at a very high heat a dirty grayish brown mass is formed from the reduction of the manganic acid to binoxide of manganese.

On adding chloride of barium to a solution of the permanganate of potash, and boiling, a precipitate is slowly formed, of a peach blossom color, while the liquid retains a deep violet color. By decanting and bringing the mass, diluted with water, on a filter, the precipitate is not decomposed and can be dried at 100° C. without changing color. When the dry permanganate of barium is gradually heated, its color also grows paler, but does not, like the manganate of baryta, acquire a green color at a still higher temperature; for after the color has once vanished, an increase of temperature soon converts it into the grayish brown mixture of the binoxide of manganese and baryta, or carbonate of baryta. Hence it is impossible to prepare the green manganate of baryta from the permanganate.

In regard to the color itself, experiments have shown that the most beautiful green is that formed by igniting the manganate as described above. The green prepared by Rosenstiehl's process,—fusing together caustic baryta, chlorate of potash, and binoxide of manganese—is less beautiful than the above; while that attained from nitrate of baryta and binoxide of manganese is far inferior to either of the others. Perhaps, however, this color could be improved by preparing it in a reverberatory furnace with a strong oxidizing flame.

The blue green baryta pigment has different shades according to its preparation, some being almost pure blue with only a shade of green, and resembling the light blue quill feathers of many parrots. The greener the color, the more it gains in intensity, but it loses in fineness, although still surpassing the green manganate of baryta.

The production of the blue or bluish green baryta color is due entirely to the alkaline property of the mass. Whether each definite color is due to a definite composition is doubtful, since the temperature, which must not exceed that of a bright red heat, exerts a great influence on the color. This much is however certain, that both manganic acid as well as the permanganate of baryta, when mixed with about 20 per cent of hydrate of baryta and ignited at a red heat, will always produce this blue green color. It is evident that the blue green color is dependent entirely on its basic character; for on placing this powder in weak acids, it first turns green and is then gradually decomposed. The baryta pigment is quite permanent, and may be subjected to the action of strong sulphuric acid for hours, at the ordinary temperature, before the color will be destroyed. Boiling potash solution has no perceptible effect on it. The permanence, especially of the blue shade, is increased by adding a little baryta, which increases its alkalinity. It is also worthy of remark that the pigment prepared from the nitrate of baryta is much less permanent, because the nitrous acid present will after a time exert a reducing action.

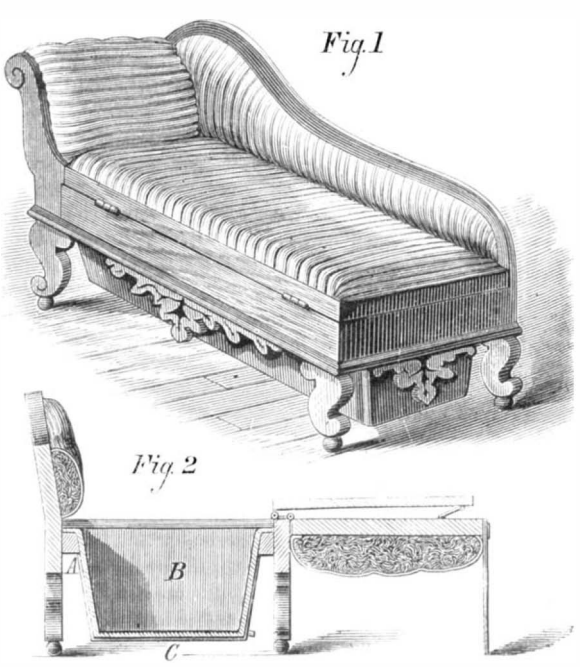
The baryta pigments seem especially adapted to fresco painting, because they appear very bright and lively on stone, and especially on lime, where many other pigments lose their beauty or are entirely destroyed.

The Bridge over the Alleghany, at Warrenton, Pa.

We are indebted to a correspondent, Mr. A. Hertzel, for the following particulars regarding the structure above named, which is one of the handsomest of the many iron bridges crossing the rivers of the United States. The length of span, from center to center of the towers, is 470 feet. The latter extend 44 feet above the abutments, the masonry of which is 24 feet above the water. The floor beams are 33½ feet long, giving a roadway of 19 feet and a sidewalk of 5 feet on each side. The two main cables are composed of 7 two inch steel wire ropes each, manufactured by J. A. Roebling's Sons, of Trenton, N. J. The cost of the work was $45,000.

COMBINED LOUNGE AND BATH TUB.

This is an ingenious combination of two indispensable articles of household utility, which will be found a convenience to persons occupying apartments in which economy of space is of importance. The invention, which was patented by Mr. Conrad Wendel, of New York city, consists in arranging, under the seat of a lounge, sofa, or bench, suitable supports, A A, for a bath tub, B, Fig. 2. The seat is hinged to the frame so as to form a cover for the tub, and to be readily thrown forward when it is desired to use the latter, in the position shown in the sectional view. The tub is provided with suitable flanges to rest on the cleats, A.



The seat is shown closed in Fig. 1, and serves to conceal the tub, and also as a cover for the same, to prevent the entrance of dust, etc. The tub is also supported by straps, C, which embrace its body at suitable distances apart, and which are secured to the frame.

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THE ARTIFICIAL MANUFACTURE OF BUTTER.

The preparation of butter from substances other than cream, and by means other than the time-honored churn, is a subject which seems to be attracting considerable attention. With the view of presenting the fullest possible information on this interesting subject, we have obtained descriptions of various plans, for butter making and refining, patented in the United States, from which we are enabled to compile a comprehensive statement of the progress of invention in this direction. The extent of the topic necessitates its subdivision, and hence, in its consideration, we propose to treat it under the following heads: Manufacture of butter and shortening for culinary use from fats; manufacture of butter from whey; modes of purifying and improving butter; and, finally, butter-coloring compounds.

THE MANUFACTURE OF BUTTER, ETC., FROM FAT.

Taking the various processes in their chronological order, the earliest on record is the patent of H. W. Bradley, of Binghamton, N. Y., and is dated January 3, 1871. It consists in a mixture of refined vegetable or fixed oil, hog's lard or stearin, and tallow, heated and agitated with water by means of a current of steam. After a suitable length of time, the oil is drawn off and allowed to cool. This produces a purified grease, which may answer for some culinary purposes, but is hardly, we should imagine, palatable for table use. The same inventor, in a specification dated October 3, 1871, describes a mode of removing the offensive taste and smell from cotton seed oil, by adding one ounce of chlorate of potash and niter to each gallon. After heating and agitation, the oil is drawn off and treated with a current of pure oxygen, the effect of which is to deodorize and oxygenate it, rendering it, according to the patentee, sweet and palatable for cooking purposes.

The modest claims above noted are somewhat overshadowed by the numerous advantages which Dr. de la Perouse, of Paris, considers are obtained by his method of preparing fatty matters, patented November 21, 1871. He proposes to render fats, however rancid, neutral and pure—to produce a low priced cooking butter, which will always remain sweet—to give the prepared material improved digestible qualities—to preserve meat by enveloping it in unoxidizable fat—to make superior candle tallow, and, lastly, to mix liquid fat with flour of leguminous plants (peas, beans, etc.), or with chopped meat, to form a nutritive food. This last seems to be simply pemmican, an article of diet well known to the inhabitants of the northern part of this continent. The operation consists in placing a tun at a time of raw fat (beef, pork, or mutton) with distilled water, in which is dissolved a quantity of the sesquicarbonates or bicarbonates of oxide of potassium or aluminum. A solution of chloride of sodium or potassium is then added, and the whole boiled, first actively and then moderately, for several hours, when all the fat becomes separated from its cellular tissue. After a repose of two or three hours, the melted fat is passed into refrigerators, and thence into casks for the market.

Mr. Alfred Paraf's patent, which is next in date, April 8, 1873, is that under which the oleomargarin butter is made. This process has already been fully described on page 246, Vol. XXIX. of the SCIENTIFIC AMERICAN, but a brief review of its salient points will not be here out of place. The fresh fat, finely chopped, is mingled with its own weight of water at 120° Fah., at which temperature it is maintained for hours. The whole is then allowed to cool, when the mixture of congealed oleomargarin, stearin, and membrane is separated from the water and worked with common salt between cylinders, after which it is placed in bags and squeezed in a hydraulic press. This operation is performed in rooms at a temperature of 60° Fah., which is the melting point of oleomargarin, so that, by this means and by the mechanical contrivances, the latter is separated. It is finally reworked with salt, and churned into butter in the ordinary manner, with a proportion of buttermilk.

Mr. Joseph R. Brown, in a patent dated December 23, 1873, proposes to purify tallow, remove its smell, and render it hard and solid at all seasons of the year, by placing the substance in one fourth its weight of water, to which two per cent of strong sulphuric acid is added. This is heated to 200°, and the melted tallow, after an hour or so, is drawn into another tank in which there is a solution of alum. The temperature of 200° is again imparted, when air is forced into the mass for half an hour. Cooling then follows, and the water is drawn off. The tallow is lastly brought to 230°, and more air driven in, when, after settling, it is made up into suitable packages. Bleaching is effected by mixing chloride of sodium vapor with the air that is forced in.

A process which seems different from any yet described, and which is claimed to consist of artificially performing the natural functions of the lacteal system of the cow, when it absorbs its fat in order to transform the same into butter, was patented December 13, 1873, by M. Hippolyte Mége, of Paris, France. The first operation is to neutralize the ferments; and to this end the fat, as soon as the animal is killed, if possible, is immersed in a solution of sea salt and sulphite of soda. Crushing under millstones follows, and then artificial digestion, at a temperature of 103° Fah. This is accomplished by a compound of half the stomach of a pig and biphosphate of lime. When the fat is perfectly liquid, showing no lumps, more sea salt is added, and it is drawn off into water, at 86° Fah., contained in wooden tubs. Here most of the stearin is deposited in the form of teats in the middle of the liquid, which then goes to a hydro-extractor, or centrifugal machine, which effects the complete separation of oleomargarin and stearin. The former, says the inventor, is an excellent butter for kitchen use, but he improves it as follows: Cream, bicarbonate of soda, and the udders of a cow, chopped, are macerated and passed through a fine sieve. This mixture, wth coloring matter, is added to the margarin, which becomes thick, tastes like cream, and, when cold, is passed through large cylinders, which give it a homogeneous mass, and complete the production. When the butter is to be kept for long periods, water is substituted for cream in macerating the udder. The stearin is used for candles or may be saponified.

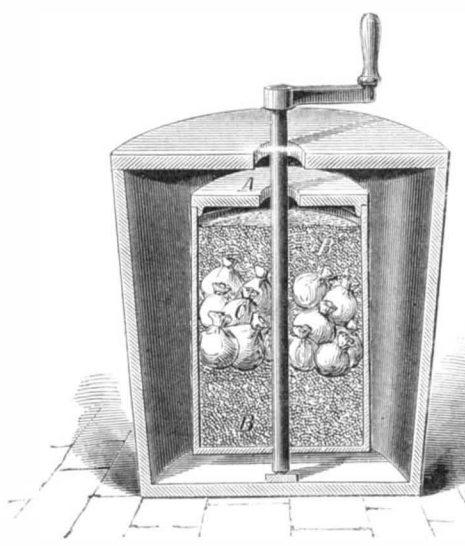
BUTTER FROM WHEY

is made by three processes. The first is that of Homer C. Markham, of West Turin, N. Y., and dated December 11, 1866. After cheese making, the whey is drawn off into a kettle, and to it is added dairy salt and a kind of acid made of old and sour whey. This is heated to about the boiling point, when the cream rises, is skimmed off, and, after cooling, is churned in the ordinary manner. The amount of whey given off by 450 pounds of milk will, it is stated with suitable proportions of the ingredients above mentioned, give three pounds of good butter.

Mr. James Suggett, of Cortlandville, N. Y., in a specification dated December 18, 1866, describes the second process, the first operation of which is to pass the whey into a cooling chamber which is surrounded with cold water. A solution of saltpeter, borax, and saleratus is added, and the whole left in the cooler for twenty-two hours, at the end of which time the cream, having risen to the surface, may be removed and made into butter.

Mr. Ira Page, of Adams, N. Y., patented June 23, 1868, the third process, in which the whey is allowed to stand 24 hours; and to the cream, which is then skimmed off, saltpeter is added. The butter obtained by churning is worked with salt and sugar.

There is another plan for butter making which, though not properly coming within the above sub-heading, may nevertheless be found worthy of notice and, doubtless, of trial. It is the invention of Mr. Adolphe Mot, of Washington, D. C., patented July 19, 1870; and we add a small engraving, which shows its construction. There are two

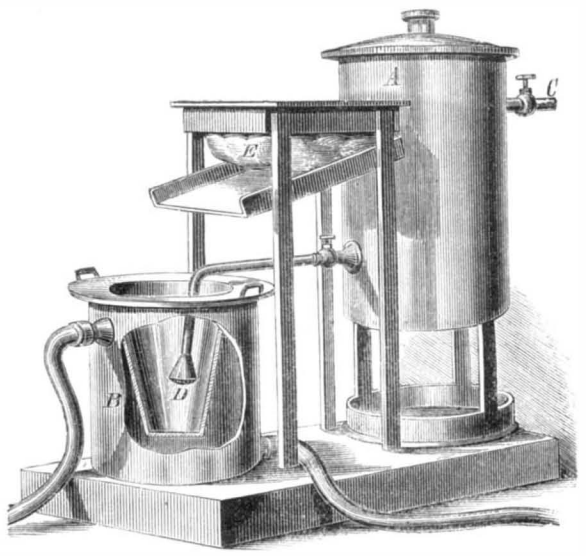


tubes, the inner one, A, of which may be revolved by suitable means within the outer. Within the tub, A, the sides of which are perforated, are placed, first, a quantity of pumicestone, baked clay, or similar porous substance, B, the cream, C, tied up in small bags, and, finally, more pumice. The effect of the latter is, after a few hours, to separate the buttermilk from the cream, leaving pure butter in the bags. Tub A is then revolved, and the liquid is projected through the perforations into the outer vessel, and, lastly, water is added for washing purposes, which is got rid of in a similar manner.

We now pass to the

REFINING AND PURIFYING OF BUTTER.

Mr. D. H. McGregory, of Detroit, Mich., patented (September 10, 1867) a process which consists in adding to one pint of milk, fresh from the cow, the yolks of two eggs and a pound of poor butter. This is churned, salted, and worked in the usual way, producing, it is stated, two pounds of fresh wholesome butter. Mr. Joseph Sigler, of Anderson, Ind., in a patent dated November 5, 1867, proposes a somewhat similar operation, churning together 1 gallon of sweet milk, 1 ounce of loaf sugar, 20 grains of nitrate of potash, 1 ounce of liquid rennet, and 10 grains of annatto, with 8 pounds of butter. The weight of the resulting compound is not given. Louis S. Robbins, of New York city, suggests, in his patent of July 28, 1868, that butter, after churning, will be less likely to turn rancid if heated to a semi-liquid condition, and then washed, first with warm and afterwards with cold water, so as to remove the buttermilk and other impurities. Butter already rancid, according to the patent of Mr. Calvin Peck, of Marshal, Ill., dated November 20, 1869, may be restored and purified by adding two ounces of pulverized alum to every five pounds of butter, the latter being melted. The butter, while still liquid, is passed through a fine sieve into clear cold water, from which it is removed and worked with dairy salt, saltpeter, and sugar. We add an engraving of the apparatus recently devised by Mr. George Kirchhöffer, of Chicago, Ill., and patented June 10, 1873. A quantity of butter in a melted condition, is put in a reservoir, A, its temperature being kept between 100° and 120° Fah. B is the congealer, which is filled with milk or buttermilk, and through the hollow sides of which a current of cold water is maintained so that the temperature of the milk is retained between 55° and 65° Fah. Pressure is next applied to the surface of the melted butter in the reservoir, through the pipe, C, and, a valve being opened, forces the butter down through the tube, D, and out of the perforated nozzle at its end into the cold milk. The congealed particles, after being skimmed, are thrown into a filter, E, through which the milk escapes and runs down the inclined trough, back into the congealer. The butter is subsequently worked in the ordinary way.



Different from any of the above plans, and apparently much simpler, is the process patented by Mr. Josiah W. Prentiss, of Pultney, N. Y., October 4, 1859. It consists simply in removing the hoops from the firkin, A, containing the spoiled butter, placing it in a bag, B, and burying the whole in charcoal, C, contained in a barrel or other receptacle. The illustration shows the arrangement, and necessitates no further explanation. Two

COMPOUNDS FOR COLORING BUTTER

have been made the subjects of patents. One, devised by Mr. D. W. Dake, of Brooklyn, N. Y., consists in adding annatto to pure oil obtained by melting the butter. The annatto is mixed mechanically with the liquid, and produces a compound of a reddish golden color, 75 pounds of oil to 5 pounds of annatto being the proportions. One or two pounds of the coloring matter suffice for 100 pounds of butter. Messrs. Bogard, Cramer & Lewis, of Laporte City, Iowa, patented September 16, 1873, another coloring compound composed of annatto, 5 ounces; curcuma, pulverized, 6, ounces; saffron, 1 ounce; lard oil, 1 pint, and butter, 5 pounds. It is said that the amount of coloring thus obtained is sufficient for 5,000 pounds of butter.

The Suez Canal.

It has been proposed that the European Powers should buy the Suez Canal, and throw it open for the benefit of the whole world of commerce. The present dues levied by the company, it is stated, are absolutely prohibitive against the greater portion of the imports and exports on both sides of the canal; and a recent increase which has been made, of some 43 per cent on the original charges, on the basis of tunnage, operates to shut out small vessels and heavy goods. Each country, it is suggested, should contribute a certain quota of the purchase money, to be estimated by a determination of the amount of benefit which each individual commerce would receive by the enfranchisement; and by this means, the entire estimated amount of $70,000,000 (at par, and without interest), it is said, could be collected. Vessels in such a case would be required to pay only such dues as would aggregate sufficient for the simple maintenance of the work, and not be heavily taxed as at present for the accretion of large dividends. It is believed that the commerce of the world would thus be immensely benefited.

Light Draft Iron Steamers.

A paper by Mr. Theodore Allen, on "Iron Hulls for Western Steamers," has lately been published in the "Transactions of the American Society of Civil Engineers." Mr. Allen is about to remove to the west, to test by practice the correctness of his theories. We give a brief summary of the paper:

In England, steamers are constructed almost exclusively

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of iron; and in this country, the proportion of iron to wooden steamers, now in process of construction, is as 21 to 4.

The first iron vessels were built in the same general manner as wooden ones, with iron ribs and sheathing. It soon became evident, however, that the same strength could be secured with much less material, by building vessels in the same manner as beams are made, and hence the introduction of the longitudinal system. This system has now been generally adopted in England for light draft vessels.

In this country, iron vessels have generally been constructed on the transverse system. The vessel proposed by the writer for service in western waters is to be built on the longitudinal system; and the bottom sheathing, to ensue great elasticity for resisting shocks, is not secured to the transverse bulkheads or frames, the connection of the bottom plates being made exclusively to the longitudinal frames. A comparison of this proposed vessel with a wooden steamer of the same general dimensions, is as follows:

	Iron vessel. Tuns.	Wooden vessel. Tuns.
Hull	147	270
Deck	112	112
Machinery and wheels	93	93
Water in boilers	20	20
Joiner work	40	40
Fuel, fittings, etc	25	25
The total weight	437 tuns	560 tuns
Mean draft	26 inches	32 inches
Cost complete	$100,000	$85,000
Durability	20 years	10 years
Value at the end of this time	$20,000	$15,000
Annual depreciation during service	$4,000	$7,000
Freight carried on mean draft	658 tuns	535 tuns
Net profit finally	$22,137	$14,250

A New Use for Chicken Feathers.

Chicken feathers are among those waste products of the farm of which no regular means of utilization has heretofore been suggested. Myriads of them are strewn over the barn yard, packed into the floor of the chicken house, or are converted into positive nuisances by the wind which bestrews them over lawns and flower beds, or drives them into open doors and windows. The down alone is, we believe, occasionally used as a stuffing for pillows or cushions, and sometimes employed as an adulteration in goose feathers; but the long plumes of the wings, sides, and tail of the bird, unless made into rude bundles to serve as dusters for the housewife, are generally regarded as totally worthless.

"According to statistics very carefully compiled," says a writer in *La Nature*, "we throw away yearly a quantity of chicken feathers, the intrinsic value of which is equal to the money which we pay out for cotton." A startling statement, but the author considers it true; and he proceeds to explain how the feathers are prepared to render them valuable: The operation is to cut the plume portions of the feathers from the stem, by means of ordinary hand scissors. The former are placed in quantities in a coarse bag, which, when full, is closed and subjected to a thorough kneading with the hands. At the end of five minutes, the feathers, it is stated, become disaggregated and felted together, forming a down, perfectly homogeneous and of great lightness. It is even lighter than natural eider down, because the latter contains the ribs of the feathers, which give extra weight. The material thus prepared is worth, and readily sells in Paris for, about two dollars a pound. About 1·6 troy ounces of this down can be obtained from the feathers of an ordinary sized pullet; and this on, the above valuation, is worth about 20 cents. It is suggested that, through the winter, children might collect all the feathers about a farm, and cut the ribs out as we have stated. By the spring time a large quantity of down would be prepared, which could be disposed of to upholsterers, or employed for domestic uses. Goose feathers may be treated in a similar manner, and thus two thirds of the product of the bird utilized, instead of only about one fifth, as it is at present the case.

The chicken down is said to form a beautiful cloth when woven. For about a square yard of the material, a pound and a half of down is required. The fabric is said to be almost indestructible, as, in place of fraying or wearing out at folds, it only seems to felt the tighter. It takes dye readily, and is thoroughly waterproof. There appears to be a good opportunity here for some ingenious person to invent machines to cut and treat the feathers.

Bergen Hill Tunnel.

Work on the Bergen Hill tunnel, for the Delaware, Lackawanna and Western Railroad, has been lately commenced in earnest. Seven shafts are to be sunk, and 500 men kept at work day and night. The tunnel begins on the east side at the foot of Ferry street, Hoboken, and will be considerably above the Erie tunnel. The track will be elevated above the Erie road, at the west end, on a trestle, thus avoiding the danger and delay of crossing. It will take two and a half or three years to complete the tunnel.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From January 14 to January 15, 1874, inclusive.

ENGINE, PUMP, ETC.—W. D. Hooker, San Francisco, Cal.
FILTERING LIQUIDS, GASES, ETC.—T. R. Sinclaire, New York city.
GRINDING MACHINE.—C. Heaton, New York city.
MAKING SCREWS, ETC.—E. Nugent *et al.*, Brooklyn, N. Y.

DECISIONS OF THE COURTS.

United States Circuit Court---Northern District of Illinois.

SHINGLE MACHINE PATENT.—HARRY H. EVARTS *et al. vs.* DAVID M. FORD.

[In equity.—Before Blodgett, District Judge.—Decided November 26, 1873.

This suit was brought to recover damages for an alleged infringement of a patent for an improvement in shingle machines, issued to H. H. Evarts, dated October 1, 1854, and extended for a term of seven years from October 1, 1868.

The court held substantially as follows:

A claim for "presenting the sides of the fibers of the wood to the action of the saws in the sawing of shingles or equivalent articles, for the purpose of giving them smoother surfaces than can be produced by the usual mode of sawing, if construed literally, asserts a right to a result, and cannot be sustained.

But it read as it should be with the specification, and interpreted to embrace the mechanism therein described, by which the result is accomplished, it is a valid claim.

A patent for a machine, in which a shingle bolt is automatically fastened by dogging teeth upon a rotating carriage which presents it sidewise to the action of a circular saw, is not infringed by a machine in which the bolt is by hand fastened to a reciprocating carriage and shoved up to the saw.

No recovery can be had upon a patent for using a machine which is neither described nor claimed in it, although the machine was originally devised by the patentee in the course of experiments which resulted in producing the patented machine, and although it has been the most extensively adopted.

If the patentee omits to notice in his patent the intermediate machines he produced in the course of his experiments, he must be presumed to have abandoned them.

The opinion of the Commissioner of Patents granting an extension is entitled to great consideration on the question of novelty, but not on a question of infringement.

Bill dismissed.

L. L. Coburn, for complainants.
West & Bond, for defendant.

United States Circuit Court---District of Massachusetts.

PRINTING PRESS PATENT.—CYRIL C. CHILD *vs.* BOSTON AND FAIRHAVEN IRON WORKS.

[In Equity.—Before Shepley, Judge.—Decided January 1, 1873.]

Letters patent No. 98,087 were granted December 21, 1869, to Charles Montague, assignee to Cyril C. Child, the plaintiff, for improvement in printing presses. This invention consisted—

1. In the use of a vibrating lever for moving the type bed, constructed in two parts, one of which is made to slide out and into the other somewhat like the joints of a telescope, so that the upper end of the lever may be attached directly to the under side of the bed (dispensing with the use of a link) and move in a direct line with the bed, the upper portion of said lever moving out of or into the lower portion, as the distance of the fulcrum of said lever to the point of attachment to the bed is greater or less in the different parts of the movement of the bed.

The plaintiff's claim is for the extensible vibrating lever in combination with a reciprocating type bed substantially as described.

Defendants admit the manufacture and sale of printing presses containing the extensible vibrating lever in combination with a reciprocating type bed, as described in complainant's patent.

The answer sets up in defense that Montague was not the original and first inventor, and also that the invention set forth in the plaintiff's patent had been in public use more than two years before the application of Montague. To sustain the defense of prior knowledge and use, respondents undertake to prove that one B. F. Leonard was the inventor. Leonard was in the employ of the respondents as their superintendent at the time that they constructed for Montague the first printing press known by the name of the "extension press," which embodied the invention of the extending vibrating lever in combination with the reciprocating type bed. This press was made for Byington & Company, and was used in printing the Norwalk *Gazette* in the summer of 1867; and it is clear from the evidence in the record that Montague had conceived the idea of substituting the extensible vibrating lever for the lever and link connection previously used as early as 1865, and had made drawings in that year clearly describing the invention, although, from the opposition he encountered from respondents, who were then building his presses under contract with him, he did not embody his invention in a practical working machine until the press was made for Byington & Company in 1867. Leonard never seems to have claimed to have been the inventor of this improvement until January, 1869, when he represented in his caveat that he had made certain improvements in mechanism for operating the platen of a printing press, and that he was then engaged in making experiments for the purpose of perfecting the same. This caveat he prepared and made oath to, but never filed in the Patent Office. This was more than three years after Montague had exhibited to two or three persons his drawing representing his improvements, and a year and a half after the respondents had made for Montague the Byington press. The testimony is conclusive that this is only one more of the too frequent instances in which a person, engaged as a mechanic or constructor in embodying the inventor's idea in a material form, attempts to prove that he was the first inventor because he made or aided in making the first machine.

The Judge held substantially as follows:

More than three years after the patentee had shown a drawing of his invention to several persons, and a year and a half after it had been embodied for him by the respondents in a working machine, a workman of theirs described it in a sworn caveat, which was never filed, and this was held not to impeach the plaintiff's claim to novelty.

An old combination employed in a new organization, and producing a new result by a new mode of operation, is patentable.

The plaintiff's patent was for a printing press in which an equable and regular reciprocating movement was given to the platen automatically by means of a lever driven by a crank, and having a telescope joint by which its length was accommodated to its position, and the patent was sustained, although, in a previous machine for rolling bayonets and the like, a gage was forced back by a cam or die, and carried with it two levers of the same character, which compressed a spring or raised a weight, and this when released carried forward the lever and the lever the gage, the movement not being regular, and otherwise not suitable for a printing press.

The patent held valid also for similar reasons, although the patentee had for two years previous to applying for it manufactured and sold printing presses in which a reciprocating movement was given to the platen by a lever attached to it by a link.

The patent adjudged to be good and valid, and decree for complainants for injunction and account, as prayed for in the bill.

E. P. Brown, for complainant.
T. M. Stetson, for defendants.

NEW BOOKS AND PUBLICATIONS.

HUSSEY'S NATIONAL COTTAGE ARCHITECTURE, or Homes for Every One. By E. C. Hussey, Architect. Price $6. Published by George E. Woodward, and sold by Orange Judd & Co., New York.

This work is a collection of sixty-three plates of pleasing and tasteful architectural designs for suburban homes, ranging from the modest cottage to ornate and handsome villas. The drawings are accompanied with full details, estimates of cost, hints as to construction, specifications, and enough general descriptive matter to enable the searcher for an appropriate plan for a projected dwelling to determine at once whether any in the pages before him will or will not meet exactly his requirements. A table of prices of building materials is added. The volume is elegantly printed on toned paper, and the plates are executed in the best style of lithography. Altogether, it is a useful and attractive book for residents in the country contemplating building. It seems to possess more originality in its designs than any work of its kind lately published.

AN ELEMENTARY COURSE OF PERMANENT FORTIFICATION. By D. H. Mahan, LL.D. Revised and Edited by Brevet Colonel J. B. Wheeler, Professor of Military and Civil Engineering, United States Military Academy. Price $6.50. New York: John Wiley & Son, 15 Astor Place.

Professor Mahan's text books on civil engineering and field and permanent fortifications are so widely and generally known that it is unnecessary to allude to the volume before us, other than as a standard work of its class. The reviser, in the new edition, has supplied several alterations and omissions in the original text, and made various necessary improvements. Prominence is given to the bastioned system over others, as it is considered as having best withstood the test of experience, and Noizet's method is carefully explained. The book is used for instruction at West Point. A large number of lithographic plates are supplied, together with the regular engravings in the text.

A TREATISE ON ASTRONOMY, SPHERICAL AND PHYSICAL, with Astronomical Problems and Tables. By William A. Norton, M. A. New York: John Wiley & Son, 15 Astor Place.

The fourth edition of this standard work appears in an entirely remodeled form, with many of its most important chapters wholly rewritten, and is, in brief, a complete exposition of the present condition of the science of astronomy from both a theoretical and practical point of view. The results of recent investigations concerning the physical constitution of the heavenly bodies are given in full, together with the author's own researches on the sun and the comets. A new and more accurate mode of determining the sun's parallax and mean distance from the earth is presented for the first time in an American treatise, and a description is also added of the astronomical observations for finding the latitude and longitude of a place as cited by the United States Coast Survey. A number of valuable tables, together with several new illustrations, conclude the volume.

ART CULTURE, a Handbook of Art Technicalities and Criticisms, selected from the works of John Ruskin. Arranged and supplemented by Rev. W. H. Platt. New York: John Wiley & Son, 15 Astor Place.

As indicated by its title, this work is a compilation from the original and exhaustive writings on art criticism which have been given to the world by perhaps the greatest living art critic. It is intended for educational purposes, and aims to give the student a thorough appreciation, based upon the correct principles of a true and refined taste, of the handiwork of the painter, the architect, and the sculptor. There is enough of the technica in the volume to render it a valuable guide to the artist, and many chapters notably those on color, light, perspective, sketching from Nature, &c., are eminently practical and clear in direction and precept. A profusion of admirable illustrations, mainly extracted from the complete works of Ruskin, are interspersed, and serve materially to elucidate the principles laid down in the text. A glossary of artistic terms and an alphabetical index of artists, sculptors, and architects referred to, are added. Press work and binding are alike excellent.

Recent American and Foreign Patents.

Improved Mole Trap.

Robert I. Huggins, Bethel, O.—To locate the trap, the earth is pressed gently down, so as to fill the burrow, and the trap is set directly above, with sill pieces parallel with the burrow, and with a cross piece on such depression. The mole, finding its hole obstructed, will commence repairing damages, and in forcing its body through the old track the cross piece will be raised, which raises a rod, and this, acting on a lever, releases a cross head which drops with its teeth on each side of the cross piece. The teeth penetrate the ground and spear the mole.

Improved Windlass and Crank for Brakes.

Henry M. Howard, Brooklyn, assignor to John Stephenson, New York city.—The windlass, around the lower end of which the brake chain is wound, is made polygonal, with the upper end reduced in size with a loose collar placed thereon, which is kept in position by a screw nut. The crank has two pairs of jaws. The former is made to fit two opposite sides of the windlass, and the latter are attached, by swivel pins, to the loose collar By raising the outer end of the crank, the jaws will be detached from the windlass and the crank may be turned round to allow the jaws to engage with any other two of the sides of the windlass. By this means the driver is enabled to take a hold of the windlass that will allow him to exert the required strength to the best advantage. When the brake is not in use, as, for instance, when the car is reversed, the crank may be thrown over so as to hang out of the way.

Improved Sash Fastener.

John G. Spathelf, Sandusky, O.—This invention consists of a casing with bolt and lever arrangement, which catches into recesses of the window frame, and is withdrawn by pressure of the finger upon it, returning into the original position by a suitable spring. On releasing the button, the action of the spring will force the lever into the next recess, fastening thereby the window at that point.

Improved Road Scraper.

Thomas M. Tate, Longview, Texas.—This invention relates to means whereby road scrapers may be loaded with more facility, drawn with less expenditure of muscular power, and made to perform an increased amount of work in a given time. The invention consists in combining with a road scraper two front wheels, movable, to let them below or carry them above the bottom of scraper; in end-angled levers, having journals and fulcrum pivots combined with wheels and bearings in the sides of the scraper; in levers connected by a bar and combined with shoulders on scrapers, and a spring latch working therethrough: and in combining with the latch, held forward by a spring, a cross bar and arm of the latch lever.

Improved Lantern.

Joseph Kintz, West Meriden, Conn., assignor to himself and P. J. Clark of same place.—The object of the construction is to facilitate insertion and removal of globes and clamping or securing them between the base and top of the lantern. The vertical guards are hooked into the top through holes in the sides so that the top can swing sidewise. They are also hooked into the bottom in slots, so that they can move up and down in them to some extent. The guards are so adjusted as to length that, when down to the lower ends of the slots, the globe will rest on its seat and the top will rest on the globe, and when they are raised up in the slots as high as they will go, the top will swing off or on the globe. They are to be pressed down by inclines, formed by notching a ring which is fitted around the bottom of the lantern, and adapted to be reciprocated to fasten or unfasten the globe by acting upon the guard wires. The horizontal guards are connected to bent pieces, and the latter are arranged so that they will slip down on the vertical guards and hold fast at the bulge so as to hold the horizontal guards in place, and, at the same time, stiffen the bottom, globe, and top against lateral motion.

Improved Car Coupling.

Frank A. Markley, Waynesborough, Va.—This invention relates to car coupling generally, but more particularly to that class of them in which is employed a link with spring grapple at each end. The invention consists in pivoting the spring catches to the hook piece as nearly as possible in the same transverse median plane, in order to shorten the coupling link, and allow the cars to come as closely together as possible. It also consists in arranging a projection at one side of the rear concavity of link slot, so far as to arrest any lateral pressure of pin against the spring latch, and thereby prevent any chance of accidental uncoupling. It also consists in using slight side latches, and thus throw the main weight and strength of the metal into that part of the link which is expected to take the strain.

Improvement in Boots and Shoes.

James McMillin, Ripley, O.—This invention contemplates the use of a wedge as a remedy for the tendency which so generally exists to wear the heel of a shoe or boot on one side. If the tendency is to wear out the subjacent edge of heel on the inner side, the thicker part of wedge is caused to abut against the corresponding side of the upper, thus throwing the strain toward the center, and not only preventing the edge wear on heel, but tending gradually to correct a slovenly habit of twisting the ankle when the weight is pressing thereon in standing or walking. If the wear should be usually on the other side of the heel, the wedge piece is reversed in position, and is in like manner productive of the same result.

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Improved Apparatus for Unloading Corn from Wagons.

Thomas Barron, Black Oak, Mo.—The parts of the bottom of the wagon box are attached to cross bars, so that the said bottom may operate as a single piece. One edge of the bottom is connected with the lower edge of one of the side boards of the box by hinges. To the bottom, near its other edge, are pivoted buttons, which may be turned into catches, attached to the side of the box to support the bottom in place. Upon the outer ends of the buttons are formed toes, to enter the forks of levers, which are pivoted to the side board of the box, and are connected so that they may all move together. One of the levers projects upward, so that it may be operated by the driver. Eye straps on the forward and rear parts of the side boards receive hooks attached to cross bars, to the centers of which are attached the ends of the ropes by which they are suspended. The ropes pass over guide pulleys pivoted to the beam attached to the frame of a corn house. The ropes are connected with a drum pivoted to supports attached to a sill of the frame. A drum is provided with a ratchet wheel and pawl to hold the wagon box suspended in any position to which it may be raised, and is operated to wind up the ropes by horses or other well known means. The upper ends of arms are pivoted to parts of the frame in such positions that a board may be swung beneath the locked edge of the bottom to form an inclined plane to guide the corn into the crib or bin as the locked edge of the bottom is detached and lowered.

Improved Fly Trap.

N. Barker McCreary and Henry L. Crist, Phelps city, Mo.—This invention is an improvement in the class of insect traps formed of an inner and outer wire gauze cage. The outer cage rests on the cross bars of a bait pan which is of sufficient depth and width to extend around the base of the cage, and admits easily the flies to the bait at the bottom thereof, from which they pass through cones into the upper chamber, where they are killed by hot water, heat, or other suitable means. A small door is hinged at one side, near the top part of the cage, and serves for the purpose of removing the flies without detaching the inner cage.

Improved Sash Pulley.

Moses Nelson, Eaton, Ohio.—The case is of metal and made in two parts. It is inserted in a hole bored in the end of the stile, and incloses an enlarged wheel of such relative diameter as to allow the sash cord to project free from each side of the stile.

Improved Potato Digger.

Richard B. Evans, Connellsville, Pa.—A scraper removes the portion of the earth which covers the potatoes, leaving a corrugated roller suspended from the beam to act with good effect upon the smooth surface thus formed. A double or V shaped plow, following immediately after, is thus enabled to elevate the earth in which the potatoes lie embedded without injury to them, and with comparatively small expenditure of force. The roller also acts as a colter wheel, in respect both to the scraper and the plow, governing the depth to which they penetrate the soil.

Improved Combination Lock.

Arthur E. Pickle, Nevada, Mo.—This invention consists of a rotating plate, having a projecting pin at one end, which engages the locking bolt, so as to withdraw the same in part by means of the inner pin of a rotating dial plate acting upon a projecting band spring, attached to the rotating plate. The withdrawal of the lock bolt is completed by the action of a second pin of the dial plate on the bolt, which is recessed and provided with inclined front and rear projections for the same. The pins of the dial plate may be changed to any combination of letters by being placed into any two holes of the concentric series of perforations provided therein.

Improved Winged Plow.

Isaac A. Benedict, West Springfield, Pa.—This invention has for its object to improve the winged plow for which letters patent were granted to the same inventor December 13, 1870. To opposite sides of the standard are pivoted arms, to which braces, fastened to the rear side of the standard, are secured by bolts, which pass through short slots in said arms, so that the rear ends of the latter may be raised and lowered, as required. Wings are also secured to the arms, and may be expanded and contracted. The inward pressure upon the wings is sustained by a cross bar, the ends of which pass through longitudinal slots in the arms, and are bent into hook form. The brace bar is further secured in place by keys which rest in notches formed in the arms to prevent the ends of the brace from slipping when adjusted. Wedge wheels are interposed between the arms and the standard, so that, by turning them, the pitch and spread of the wings may be adjusted to suit wide or narrow rows, and turned down flat for shallow culture, or set up for hilling corn or potatoes.

Improved Die for Forming Hammer Eyes.

Henry Harrison Warren, Bridgewater, Canada.—The object of this invention is to furnish an improved means for forming the eyes of nail and other hammers, of the shape and style of the "adze-eye;" and it consists in constructing the dies with recesses or forming surfaces which will give the eye of the hammer blank the preliminary form necessary to the proper action of a punch or plunger employed to finish the eye.

Improved Apparatus for Painting Broom Handles.

John Reif, Kossuth, Wis.—This invention is an improvement in apparatus for painting or ornamenting broom handles by means of bands or stripes, and consists in a series of strings or cords so arranged upon a frame that paint may be applied to them, and thus transferred to the broom handles when the same are subsequently rolled over them.

Improved Feed Wheel for Saw Mill.

John Kerr, Milltown, Canada.—The object of this invention is to produce a feed mechanism for saw mills, which will be absolutely regular, and equalize the movements of the saw carriage to such an extent that each cut or stroke of the saw will be equal to every other cut or stroke. The invention consists in the application of a friction shoe to the V shaped rim of the feed wheel, and in its connection with the operating mechanism in manner that will, when the shoe is drawn in one direction, cause the wheel to be turned, while the wheel will not be turned when the shoe is moved in the other direction.

Improved Clamp.

Jacob F. Schneider, Brooklyn, N. Y.—This is a strong and adjustable clamp connection for the several parts of wooden boxes or other objects where the parts are made detachable for the purpose of transportation and readjustment. It consists of two plates with bent edges, which are slightly inclined toward each other, and applied to the pieces to be connected. A plate with downward bent edges, with similarly inclined sides, is driven over the side plates, holding them rigidly together, and forming a strong connection of the parts.

Improved Floor Clamp.

Robert C. Davidson, Evanston, Wyoming Ter.—There is a plate for protecting the edge of the flooring, and a pawl for holding the clamp after clamping up the flooring. The connecting screw has a nut for adjusting the bar according to the thickness of the joist to which the clamp is to be fastened. A key is fixed in said screw to cause the nut and bar to shift together. Said key shifts along the screw with the nut and bar in a groove in the screw. A set of pointed stud screws is provided in the bars, near the connecting screw, for screwing into the joist to hold the clamp when it may be necessary to release a lower set of screws to shift them forward to get a new hold, in case the flooring is not clamped up sufficiently by the first operation. The bars are placed in the joist close to the edge, and fastened by the screws. The upper end of the clamp is then pressed forward, so as to press the flooring together by the plate.

Improved Machine for Sprinkling Cotton Plants.

William T. Robinson, Huntsville, Texas.—A two wheeled truck, of proper hight and width, is arranged to run along above one row, and provided with a tongue to hitch on the animals, so as to go on opposite sides of the row. There is a liquid holding tank on the front part of the frame, which has a sprinkling tube, of suitable size for sprinkling the liquid upon three rows of cotton. Behind the truck is a horizontal shaft, extending each way beyond the wheels, for reaching over the outside rows, and carrying revolving sieves for sprinkling on powdered substances. By suitable arrangement of the mechanism, the plants are first dampened with water and then overspread with poisonous powder, the former causing the latter to adhere to the plant.

Improved Bung Bush Inserter.

Lomax Littlejohn, New York city.—The object of this invention is to improve the bung bush inserter for which letters patent No. 138,568 were granted to the same inventor May 6, 1873, to make it impossible to burst the bush, however much power may be applied. By suitable construction, when a sleeve has been inserted in the bush, and a shank turned, an elliptical journal will expand the sleeve, causing it to grasp the bush firmly, and screw it into the bung hole in the stave. In case the stave is hard, and considerable power is required to force the bush into place, the powerful expansion of the sleeve will sometimes burst or split the bush. To remedy this, a tongue is attached to the elliptical journal, which enters a slot in the sleeve, which strikes against the side of a shoulder of said slot, and thus turns the bush, the said tongue and slot being so arranged that the sleeve will be expanded sufficiently before the tongue strikes the shoulder of the slot.

Improved Apparatus for Manufacturing Illuminating Gas.

John G. Müller and William Müller, Dayton, O.—The gas retort, of cast iron, is placed longitudinally in a furnace, which is constructed of fire brick, in the usual manner. Coal oil is fed to the retort from a tank as the formation of the gas progresses. The retort connects, by a conical neck and pipe, with a hydraulic valve. The gas, which is formed after the retort is at red heat, passes up through the bottom of the valve. The mouth of the entrance pipe has a conical cap, which is open at the bottom and placed in water, through which the gas is forced and cleaned from the tar vapors. The top part of the valve is made airtight by being placed with its lower end in tar or other fluid, on the outer casing of the valve, as usual in gas factories. The gas passes then from the valve to the purifiers, which are filled with coke, and thence, by a hydraulic valve, to the gasometer.

Improved Music Leaf Turner.

William H. King, Petersburg, Ind., assignor to himself and Jerome Borer, of same place.—The object of this invention is to provide an improved music leaf turner for sheet and book music, by which the leaves are readily turned as required during the playing of the instrument, and firmly retained in position on the rack or stand, whether they are placed singly or in book form thereon. The invention consists of a frame which is attached by its base piece to the rack of a music stand or piano. Upright connecting bars are pivoted to the base piece and top piece, by means of which the latter is adjusted parallel to the base piece and the supporting bottom bar of the rack. The top piece is slotted for the arms, which are pivoted to a common center pin, and applied by flat end wings to the sheets to be turned by a sliding plate, which catches by staples and slots into the forked ends of the arms. The sliding plate is drawn from side to side by cords and pulleys connected to a knob on the base piece.

Improved Wheel for Vehicles.

Frederick H. Brinkkotter, Quincy, Ill.—Flanges rise out of the surface of the hub cylinder at a considerably greater distance from each other than the breadth of the spokes, and incline toward each other for the greater portion of the distance to the periphery. Near the outer edges they make a short turn directly toward the spokes, and for the rest of the distance they are parallel to each other, and have a flange on the inside, and form a dovetail shaped annular chamber, in which are collars of wood, divided in two parts, for putting them in. They are coated with white lead, to prevent them from shrinking, and the spokes are driven in so as to wedge tightly all the way to the bottom. The inside of the hub and also the exterior of the box are provided with short spiral ribs, near each end, to lock the box against end motion, by turning it after it is inserted in the hub, so that the ribs bear against each other; and near the outer end of the box is an annular ring, against which is a leather washer, to pack the joint tight by a flange of a nut. The wheel is placed down, with the inside of the hub up, the box centered at that end, and the space finally filled with melted sulphur.

Improved Earth Closet.

John L. Young, New York city.—A hinge is attached to the cover and to the casing, by means of which the service pan and shutters are operated, and which consists of a bar which is attached to the edge of the cover, having a branch thereon. Connected with this is mechanism so arranged that, when the cover is raised, the service pan is carried forward beneath the seat, taking with it a layer of earth equal in thickness to the width of the discharge mouth. The excrement falls upon this layer of earth. When the cover of the seat is closed, the pan is drawn back, and the contents of the pan are deposited in the tub beneath. The thickness of the layer of earth on the pan may be of any width. The shutters are two pieces of metal, with their ends turned at right angles and pivoted to jambs, so that they will fall and close together by their own gravity. They are opened, when the cover is raised, by means of the turned up edges of the service pans, which strike cranks, which raise the ball as the pan is carried forward. The hinge is of such peculiar construction and so applied that the shutters are neither opened nor closed until the cover is thrown almost back against the front of the hopper.

Improved Plane Guide.

Walter S. Shipe, Minerva, O.—This invention relates to an improvement in plane guides, by which the plane is steadied, in squaring or bevelling, to any desired angle without the use of a try square or bevel; and consists of a yoke, which is firmly applied to the plane, and provided, at one end, with a pivoted guide strip, which is adjusted, by clamping screws, under any required angle to the plane.

Improved Sugar Manufacture.

Herman M. Aschenbrenner, Havana, Cuba, assignor to himself and Theophilus Masac, same place.—The juice passes from the grinding mill into a conveying tank with two sets of filters, which operate alternately. The conveying tank discharges into the flannel filter, and the juice falls into a tank which has three outlets corresponding with three open kettles. In these kettles, in successive order, the cane juice is precipitated, by means of lime and magnesia, and the sediment is drawn off. Thus purified, the juice passes through the siphons into the last filter, and then, by the suction pump, is forced into the sulphur box. This box, of wood, has inside a paddle wheel, worked by the steam engine of the mill, and is fed with sulphurous fumes from the adjoining sulphur furnace. The juice leaves the box in a perfectly bleached condition, passing upon a metallic box of sheet metal, heated inside by steam, and serving to raise the temperature of the juice to not over 90° centigrade, by a condensation of 32° to 33° Baumé. There it goes into a communicating canal, upon the inclined plane, also heated by steam and provided with an outlet, and finally is acted upon by a blast from a steam fan placed at the lower end of this inclined plane. The juice becomes now so thick that it has to be scraped with the slowly revolving scraper, which is constructed like an endless apron, provided with suitable scraping blades, and actuated by power transmitted from the engine. There is another smaller and more inclined plane, similar to the former one, and also fanned by another fan, from which plane the sugar, already crystallized, is scraped off, by hand or otherwise, into the final receiver. A complete description and illustration of this invention will be found on page 367, vol. XXIX., of the SCIENTIFIC AMERICAN.

Improved Package for Caustic Alkalies.

Henry, B. Hall, New York city.—This invention relates to the caustic alkali package, consisting of a spun or stamped metal cup, with a hermetical cover of resin and wax or the like material, formed by pouring a gummy substance, in a melted state, over the alkali, with which the cup is filled; and it consists of a metal disk or cover of tin or other suitable substance put in before the gummy sealing material is put on, and made to spring into a small groove in the inside of the cup near the top. The object is mainly to utilize gummy sealing matters or compounds for closing metal packages containing broken caustic soda. The sealing substance cannot well be used without said metal cover, in consequence of its settling down in the spaces between the pieces, and cementing them together, causing considerable waste, besides interfering with the use of the soda.

Improved Pen Wiper.

Hugh S. Ball, Spartanburg, S. C.—This invention consists of two sponges held in suitable metal cups affixed to the ends of bent lever arms. The latter are so connected with a suitable standard and with each other that when the pen is lightly pressed upon the lower sponge, sufficient force is exerted to bring the upper sponge down upon it, so that both sides of the pen are thereby cleanly wiped.

Improved Farm Gate.

David A. Neidig, Paris, O.—This invention is an improved gate for self-closing and self-latching, and answering the purposes of a small farm gate for the passage of persons on foot and horseback as well as those of a large farm gate. The gate works easily and conveniently, is cheap and durable, and lifts clear above the snow. When the gate is closed, a supporting rail extends through its full length, and rests with a semicircular notch on the pulley of the main post. When pushed open to the side, the gate slides on the supporting and inclined rails, and, being self-closing and self latching, into its former position. When it is desired to keep the gate open for ordinary purposes during the day, it is pushed back till it rests on a long notch on the inclined rail, which raises also the forward end of the supporting rail, and locks it into the top of the main post, bringing the gate to a level. In this position the gate cannot be swung around, and in order to do so, so as to make room for a load of hay or other bulky substance, it is necessary to push the gate into a second or shorter notch, which causes the forward end of the supporting rail to drop into a semicircular recess, from which position it can easily be lifted and, the gate being properly balanced, swung around.

Improved Can for Transporting Oil, etc.

James E. Pimley, Newark, N. J.—The ends of the cover extend down and overlap the sides of the body, and are fastened by screws put in so that they can be taken out readily, to remove the cover altogether while the contents are being drawn from time to time for use. A tapered nozzle is constructed without a bead at the top, so as to secure a tapered cap, which is provided with an annular groove, to fill with plaster of Paris or other cement in a plastic state when the cap is put on for sealing it up tight. The cement is broken loose by a few taps with a small hammer or other instrument when it is to be taken off. There is a funnel around the vent hole, to hold the cement for sealing the vent for transportation.

Improved Wire Stretcher.

Isaac H. Congdon and Jacob E. House, Omaha, Neb.—This invention consists in the mechanical application of an iron frame and rollers for the purpose of adjusting or giving a uniform and constant tightness to the iron wire used in the construction of wire fences. The rollers are of hollow cylindrical shape, secured in suitable frames on either side of a post, and are provided with flanges in which are holes for the insertion of lock pins, which prevent the rollers from turning back after the wire has been tightened. The wire is attached by its end to one roller, and is adjusted thereon by a crank handle, which is carried by the attendant from post to post, so that very extensive fences can be easily set as desired.

Improved Fountain Pen.

Henry N. Hamilton, White Plains, N. Y.—The handle of the pen is made hollow, and is tapered at its lower end. In the inner surface of the upper end of the handle is a hollow screw plug, with a closed lower end, and with a hole through its side. Secured to the screw plug is a rod which extends down to the tapering part of said handle, and has a valve to fit into the lower part of the cavity, so as to prevent the outflow of the ink, unless the rod and valve are slightly raised. A nut, which is screwed into the hollow screw plug, is perforated from its lower end, from the upper end of which a perforation leads out through the side of said plug. By turning the plug up a little, the valve is raised from its seat to allow the ink to flow out. The nut is then unscrewed sufficiently to bring its side perforation above the plug, so that the air may pass in to cause an outflow of the ink.

Improved Sugar Cane Cultivator.

Henry Von Phul, Jr., and James Mallon, Holly Wood, near Baton Rouge, La.—The mold board is hinged to a standard and the land side. The land side produces, with the mold board, the shape of a slanting V. The position of the mold board and land side is regulated by a curved lever which is pivoted to a supporting bar of the land side, and connected by a pivoted bar to a projecting lug of the mold board. For expanding the fluke to its largest width, the handle end of lever is locked by a pin, through a hole near its handle, into a hole of a projecting bar of the land side. By suitable means the width of the fluke may be contracted as desired.

Improved Velocipede.

George Avery, Ottawa, Ill.—The rear axle is provided with a crank for each pedal bar, which are so arranged that the bars are made to act alternately on the axles, the weight of the driver being first thrown upon one bar and then upon the other. The power is applied when the cranks are in a horizontal position, when the weight will have the greatest effect. The arms of the steering lever are attached to the forward axle. The frame rests upon the axle at the rear, and upon the bolster in front, the forward axle being bent to allow the bars to play. The bars are jointed to the forward end of the frame, and foot pieces are on each of the bars, one each side of each joint. The driver stands upon these bars, with his feet on the foot pieces, and propels the machine by throwing his weight first upon one bar and then upon the other alternately.

Improved Ore Washer or Buddle and Ore Separator.

John Collem, Idaho Springs, Col. Terr.—The first invention is a revolving buddle. The finely crushed ore, consisting, for instance, of quartz, copper pyrites, iron pyrites, and galena, is conveyed by water through a suitable spout into the distributing box, from which it passes through small holes, and spreads itself uniformly upon the surface of the table, the heavier minerals settling mostly near the center, and the lighter near the periphery but still in a mixed condition, as the separation caused by the running water only is very imperfect. As the table revolves the minerals are subjected to the combined action of the clear water from the distributing box, and the stirring of the brooms, which causes the quartz and other light earthy matter to pass to the periphery of the disk, and then to fall into a suitable receptacle; while, owing to the jarring action of the pounders and the greater density of the other minerals, the latter still remain on the buddle. The copper pyrites, and then the iron pyrites, being subjected to the action of the other brooms and larger quantities of clean water, are each passed to the circumference, and deposited in separate receptacles. The galena still remaining on the table may be removed by other brooms or scrapers, or be washed off by strong jets of water. The same inventor has also patented an improved ore separator which consists of two or more grading sieves in the upper portion of a tank of water having appropriate discharge passages for different grades of material escaping. These are actuated in the water by suitable mechanism, and also have a washing attachment so arranged that currents of water are caused to flow upward against the descending currents of ore. The "slime" water is thus separated from the coarser particles, and caused to flow, with the fine particles of ore, into another tank, in which is a siphon pipe adapted to collect that which is sufficiently heavy to settle to the bottom of the water in said tank and convey it to a proper receptacle.

Improved Station Indicator.

John W. Newlin and Jacob S. Simmerman, Millville, N. J.—This invention is an improved station indicator for railroad cars, so constructed that the indicators throughout the train may all be adjusted at the same time. The front of a rectangular box has a transparent portion in its middle part, to allow the names of the stations to be seen. The names of the stations are printed upon strips of wood. The upper parts of the strips have hook-shaped slots. Vertical pieces are attached to the top of the box, and to their lower inclined edges are attached metallic straps, in such a way as to form inclined slots. Other pieces with upper edges inclined to the rear are attached to the bottom of the box, and their forward ends extend close up to the door. The lower edges of the strips incline downward. A shaft, which works in bearings attached to the box, carries three arms. The first arm projects downward into such a position as to strike the clapper of a bell. The second arm, when moved forward, strikes against the end of the lowest name strip, and pushes it longitudinally until it drops upon the inclined edge of the lower vertical pieces, down which it slides to the rear part of the box. The third arm passes out through a slot in the end of the box, and has a pulley pivoted to its end, to receive a cord which is kept in place upon the pulley by a spring which allows the cord to be slipped off and on conveniently. The cord extends through all the cars of the train. When the cord is pulled the effect is to raise all the arms, which strike the bells, and push the lowest strips from their places and expose the next strips. When the end of the route is reached, the strips will all be upon the lower vertical pieces, and arranged in proper order for the return trip, so that all that will be necessary to rearrange the indicators will be to raise the strips, and hang them upon the straps of the upper pieces.

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Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Ms.

ANSWERS TO CORRESPONDENTS

A. E. C. can repair his meerschaum pipe by following the directions on p. 90, vol. 30.—J. F. and others will find explicit information on the subject of sumac in any good work on botany.—G. C. B. can repair rubber boots by the process described on p. 155, vol. 26.—C. S. & Co. will find directions for bronzing malleable iron castings on p. 203, vol. 29.—C. B. and others can obtain the lenses for the cheap telescope described on p. 7, vol. 30, from any optician.—A. S. will find directions for repairing rubber overshoes on p. 155, vol. 26.—J. H. should address the engineers of the Hoosac tunnel for the information he seeks.—J. W. A. will find a description of nickel plating on pp. 91, vol. 29, and 187, vol. 28.

C. H. F. says: 1. In a self-feeding stove, the pipe runs 8 feet horizontally from the stove, and then some 12 feet perpendicular into the garret, where it runs 20 feet horizontally and enters the chimney. A substance is constantly dripping from this 20 feet of pipe in the garret, and it eats its way through the pipe in a short time. There is no possibility of any water getting into the pipe from the chimney. I send you a few crystals which formed on the perpendicular part of the pipe in the garret where this substance runs down on it. What causes this substance, and what are the crystals composed of? A. Probably some corrosive substance is distilled from the coal, and condenses in the pipe. The specimens sent seem to be sesquioxide of iron. 2. How can the tone of a church steel bell that is cracked be restored? Could it be done in the steeple? The bell is so hard that steel tools will not cut it. A. We scarcely think it can be done. 3. Is there a substance, and if so how is it made, that will take the temper out of steel or soften it, so that it can be drilled without heating? A. We do not know of any. 4. Which will stand the most pressure, a copper or an iron boiler, both of the same size and thickness? A. An iron one.

J. E. W. asks: 1. Why can a gimlet pointed screw be driven more easily with a long screw driver than with a short one? A. On account of the greater leverage that can be obtained by inclining the long screw driver. 2. Can the same screw be driven more easily with a pressure on the screw more than enough to keep the screw driver in place? A. We think not.

F. D. asks: 1. How can I get a good spring temper on steel wire? A. Temper in oil. 2. How can I case harden it? A. With prussiate of potash. 3. If I case harden it, will it make it break more easily? A. We think it will.

F. F. R. asks: 1. Will a common horseshoe magnet, if bent straight, have the same qualities as a compass needle, as to polarity? A. Yes. 2. Would a compass needle lose its power if it were confined so that it could not turn on its pin, a weight being put on the cap of the needle so that it cannot move? If I turn the compass so that the north end of the needle would point south and let it remain for six months, what would be the result? A. Probably it would lose a little of its attractive force. 3. Is there any motor run by a magnet? A. Yes.

C. A. W. says: 1. It seems to me that, in the present state of steam engineering, there ought to be rules for the construction of slide valves that would be generally recognized by builders as giving the best result for average speeds. The diversity of practice seems to be as great as the number of builders, and the theories equal the mechanics in number. I know builders who give so large a compression in some cases as to force the valve from its seat, while others release almost as early as the cut-off, and have practically no compression. I should suppose that the most economical point of cut-off, release, and compression would have been determined approximately, by actual experiment by this time. Is there no work treating on these questions? Auch incloss assumes these points to be determined, and then gives rules for constructing valves accordingly. A. We think the subject is treated in several manuals of the steam engine and locomotives. 2. Are sirups prepared from starch, cotton, wood fiber, etc., by the use of sulphuric acid or other re-agents deleterious? And is there any simple test for detecting deleterious qualities? A. We think not, in general. Probably the simplest test would be with litmus paper.

R. H. says: In a shop heated with exhaust steam, conveyed through pipes made of galvanized iron the heat does not seem to radiate, no matter how much steam is turned on. Why is this? A. Probably the trouble is caused by insufficient radiating surface or too little steam.

W. asks: In estimating the heating surface of a vertical boiler, should the surface of those parts of the tubes be measured which project above the surface of the water, through the steam chest? Is not the heating surface as great in a boiler where the tubes only extend to the surface of the water as in a boiler of same dimensions where the tubes extend to the top of boiler? A. The heating surface is greater where the tubes extend the whole distance.

T. J. McM. asks: How can I divide a given straight line into two parts, so that the square on one of the parts may be double of the square on the other? A. You can solve the question, to any degree of approximation desired, by the following formulas: Let l = length of the line. Lesser part $= l \times \sqrt{2} - l$. Greater part $= 2l - l \times \sqrt{2}$.

T. C. W. asks: 1. Can you give me a recipe for making blackberry wine? A. Cook the berries slightly; let them stand until the next day. Then strain them, add 1 quart of water and 3 pounds of brown sugar to each gallon of the juice. Place the mixture in a cask, cork tightly, and let it stand until the following March, when it can be bottled. 2. Is it a healthy drink or not? A. We think so. 3. Would it not be practical to ring the bells in the different churches by telegraph, providing each church had its own battery, and could not one man ring all the bells in one church? A. Yes. 4. Can I get the different drawings and specifications of all the patent ice elevators? How can I find out how many have been patented? A. Yes. You can only find out the number by a search. 5. Can I have my hydrant so arranged as to force the water out of my cistern into water pipes through the house, without letting any water out of the hydrant into the cistern? A. You can probably do it by putting up a water engine, to be driven by the water from the hydrant. 6. Can you give me a good recipe for hair oil that will not injure the hair? A. Probably castor oil is as good as anything. We cannot answer your other question, as the *data* are insufficient.

J. T. H. asks: Should the propeller be of a greater or less pitch at the center than at the perimeter, to avoid drag? A. There is a great difference of opinion among engineers on this point. Makers of propellers with varying pitch assert that their screws, when in motion, do not shake the vessels so much as equally efficient screws with constant pitch.

J. W. D. E. asks: 1. How many different kinds of fire engines are there in use? A. Hand engines, steam engines, chemical engines. 2. How much fall is usual on canals? A. They are generally level. 3. What is the common width? A. The widths vary greatly in different localities. 4. Is it essential that canals should be walled up? If so, would brick be cheaper than any other material? A. Generally canals require to be walled up, but we do not think that brick is the most suitable material. 5. When will the committee decide between the competitors for the reward offered by the State of New York? A. The time during which competition was allowed has expired.

N. L. T. asks: 1. How can I compute the pressure exerted outward by a ball weighing 1 lb., revolving in a circle the radius of which is 1 foot, at 1 revolution per second? Is there any fixed rule for determining the centrifugal force of a body? A. The centrifugal force of a body =

$$\frac{(\text{Weight in pounds}) \times (\text{velocity in feet per second})^2}{\text{radius} \times 32{\cdot}2}$$

2. Do you know of any book published on the compass and the variations to which the magnetic needle is liable, treating the subject in such a way as to enable a person to acquire the skill and knowledge requisite for an expert surveyor? A. Gillespie's "Treatise on Land Surveying" has considerable information on the subject of the compass.

W. J. B. asks: What is the most reliable work on superheated steam, and where may it be obtained? What is the greatest number of degrees of heat that can be obtained from superheated steam? A. We do not know of any work that will answer your purpose. Steam can be superheated to any degree that the apparatus will stand. It would probably be well for you to consult an experienced engineer about the matter, as in this way you will avoid costly experiments.

T. L. C. asks: 1. What is the greatest perpendicular hight to which the waves on the ocean rise, measuring from bottom of the trough? A. From 30 to 40 feet, we think. 2. What is the distance between them from top to top or center to center? A. About the same as the hight. 3. How far below bottom of trough is the water agitated by the strongest wind and largest waves? A. Probably about 2,000 feet.

M. J. S. says: I have a hollow rectangular vessel, two feet long and four inches square, made of sheet steel, one sixteenth of an inch thick. Can I pour in molten cast iron to make a solid piece, and secure a perfect weld with the steel without deteriorating the quality of the steel? Which is the best method to perform the operation? A. We do not think you can do it.

W. L. asks: Is any injury to be apprehended in firing a boiler with the dust from mixed fabrics whence the wool has been extracted, from greasy rags with oil of vitriol? A. We scarcely think that any injury will result from the use of this material.

G. W. V. G. asks: 1. Will a thermometer indicate the same temperature hanging in the wind that it would if sheltered from the wind, everything else being equal? A. Probably the indication would be lower in the wind. 2. Is the temperature when air is put in motion by a fan or bellows changed? If so, what is the cause? A. We think not, materially.

G. A. E. asks: 1. In the electrical plate machine described on page 402, vol. 28, if the disks are of glass, is it absolutely necessary to the proper working of the machine that the lower disk should be $\frac{1}{8}$ and the upper $\frac{1}{16}$? Or is it only necessary that the lower one should be twice the thickness of the upper? A. Probably the relative thickness is not a matter of great importance. 2. How or where can I get ebonite? A. Ebonite is made by heating india rubber with half its weight of sulphur. You can doubtless obtain it from a rubber factory.

L. W. M. says: We conduct escape steam through our building with tin pipe, for heating purposes. The pipe is not painted inside. Is there any way that we could coat the inside of the pipe without taking it down? We think we could economize part of the escape steam if we could apply some good radiator. A. We scarcely think you can accomplish this.

E. P. C. asks: In Bourne's mode of setting the eccentrics, what is meant by "the center of the eccentrics"? A. It has the same relative position as the center of any circular figure. 2. When a train of cars is going around a bend in the road, do the inside or the outside wheels slip on the track? A. The outer wheels will slip the most, if both have the same diameter.

A. B. D. asks: 1. What will remove black worms from the face? A. Friction with a rough towel has been highly recommended by some of our correspondents. 2. Are the so-called black worms living insects, or merely a secretion? A. We think they are secretions of matter. 3. Are hot air furnaces bad for the health? If so, what is a better and not too expensive way of heating a house. A. This is a matter about which there is a great diversity of opinion. For our own part, we think that hot air furnaces, in which water is constantly evaporated, may be used in well ventilated houses without injury to health.

A. C. E. says: 1. I have a small library of about 400 volumes which I wish to arrange and catalogue. What is a good method for so doing? A. It is a good plan to arrange the catalogue alphabetically, according to the names of the authors of the works. Example: "LLOYD, HUMPHREY. Elementary treatise on the wave theory of light. 2d edition, 1 volume, 8vo. London, 1873. 2. E." The figure 2 refers to the book case, and the letter E to the shelf on which the book may be found. 2. In sharpening a knife or a similar tool, when the grindstone is turning towards you, should you hold the sharp edge of the knife toward you or from you? A. The latter way.

E. E. B. asks: What course of study is necessary for a civil engineer? What books are necessary, and where can they be procured? A. Send to some publisher of scientific works, for his catalogue, in which you will find the different subjects classified. You will see the advertisements of such publishers in the SCIENTIFIC AMERICAN.

A. S. asks: How can I stop the leak in an aquarium? One of the glasses is cracked. A. Probably you can stop the leak by the use of marine glue.

T. E. asks: How can I ascertain the amount of any given element in any given mineral, for instance the lead in galena, or the zinc in blende? A. It can be ascertained approximately by a careful blowpipe analysis.

R. C. G. asks: How can I tin pieces of iron wire? I have tried dipping them in melted tin, but cannot prevent their sticking together, and they are very rough and unevenly coated. A. Probably you will have to arrange the pieces so that they can be dipped separately, and wiped off as soon as removed from the tin bath.

C. D. says: We have a private telegraph. My station would not work; upon seeking for the cause the copper insulated wire (running from the street wire into my cellar) was found corroded at the two ends of the cellar window where it touched the brick wall. Will you inform me of the cause of this corrosion at these two points? A. Gases that corroded the wire might have been given off from some place in the vicinity.

J. M. D. asks: What will be the advantage of inserting a ⅜ inch pipe into each end of a cylinder thereby making direct communication from one end to the other? The object of this is to provide for the drainage of the cylinder. A. As we understand the question, the effect will be to increase the back pressure on the piston.

H. F. M. asks: 1. How many feet to the mile are there in a grade of three degrees? A. About 275 feet to a mile, measured on the incline. 2. How can I ascertain the amount of water that a roadside gutter will carry? A. Knowing the construction, you can determine by experiment the velocity, and consequently the amount of water discharged in a given time. 3. How much fall should be given to an open spout, made of two planks nailed together, in a distance of 500 feet so as to carry 30 gallons of water per minute? A. You can use the formula given on p. 48, vol. 29, multiplying the coefficients there given by 0·571. In this way you can find the inclination necessary for a wooden pipe. Then make your trough so that the wet surface is the same as the surface of the pipe. 4. Is there any way to repair the screw on a common auger when it is slightly damaged or worn? A. It can often be done with a file. 5. Is there a way to clean kerosene barrels, so as to make them fit for packing meat in? A. We think they can be cleaned by steaming. 6. What is the best way to wash flannel? A. This is a disputed point. Perhaps the ladies, who know all about such matters, will send us their views.

G. R. E. says: 1. In your article on the initial velocity of projectiles on p. 400, vol. 29, you say that the circuit of the battery of the Bouton instrument can be closed or broken at will by means of a disjunctor. What is that disjunctor composed of, and what is its position? 2. In the description of the Schultz chronoscope, you mention the interrupter, and say it closes and opens the circuit about 500 times per second; can you explain it? A. In these instruments an electro-magnet is employed and the attraction is destroyed by interrupting the connection of the conducting wire with the battery. 3. What will cut off or stop the current of a common horse shoe magnet? A. We do not know of anything that you can use to cut off the attractive force of a permanent magnet.

C. R. asks: In the compound engine, in which the steam does duty twice, what is the ratio between the first and second cylinder? A. From 2·5 to 5. 2. What gain is claimed for this sort of engine? A. Greater facility for a high grade of expansion, and less cooling and reheating of the cylinder during alternate strokes. 3. Is there not a back pressure on the piston of the small cylinder on the return stroke? A. Yes. 4. Is there any way of avoiding this back pressure, and, if it could be obviated, would not the gain be large over the ordinary engine where the steam is used only once? A. Reducing this back pressure reduces the working pressure in the second cylinder.

G. E. W. asks: Is not the curvature of the earth for the first mile nearer six and a half than eight inches? Reckoning diameter eight thousand, and circumference twenty-five thousand, miles, the fall from pole to equator is four thousand miles, of course. Then, as the square of 6,250 miles is to the square of 1 mile, so 4,000 miles are but a small fraction more than 6¼ inches. A. The polar diameter of the earth is 41,707,536 feet, or 7899·155 miles; the mean diameter at the equator is 41,847,662 feet, or 7925·694 miles. It is sufficiently accurate, in calculating the curvature of the earth, to regard it as a sphere with a diameter of 41,778,000 feet = 13,926,000 yards = 7912·5 miles. The curvature for any distance, all dimensions being taken in feet, is found by dividing the square of the distance by 41,778,000—or the curvature, in feet, for any distance expressed in miles, is equal to two thirds of the square of this distance. For a distance of 5,280 feet, or one mile, the curvature will be $\frac{(5280)^2}{41,778,000} = (1)^2 \times \frac{2}{3} = 0{\cdot}667$ feet as given in the table. 2. Has a telescope a lifting power, so to speak, as well as a power for enlarging; and, if so, are the two powers equal? A. In general, a correction for refraction (which makes the object appear higher than it really is and thus reduces the curvature) should be applied. This varies with different states of the atmosphere, but its average value may be assumed as one sixth of the curvature, so that the corrected curvature is five sixths of that given by calculation. Hence it appears that the curvature, at a distance of one mile, corrected for refraction is, on an average, $\frac{(5280)^2}{41,778,000} \times \frac{5}{6} = (1)^2 \times \frac{5}{9} = 0{\cdot}556$ feet. 3. From what bases have the earth's circumference and diameter, as these are now measured, been estimated? A. By the measurement of the lengths of a degree of latitude and longitude at different parts of the earth's surface.

R. J. B. R. asks: At what age does a person usually stop growing? A. Some one has recently published the following *data* in regard to the growth of men and women: Average weight of boys at birth, 6½ lbs.; average weight of girls at birth, 6¼ lbs.; average weight of males at 20, 143 lbs.; average weight of females at 20, 120 lbs. Men acquire greatest weight, on an average, at 35, weighing 152 lbs., women, at 50, weighing 128 lbs. Weight of an average man or woman when full growth is attained is about 20 times that at birth.

J. G. asks: Why will a hollow cast iron cylinder sweat on the inside when a flame of illuminating gas is turned into it for heating purposes? Is it because the moisture is contained in the pores of the iron and liberated by heat, or is the gas condensed into water upon coming in contact with the cold surface of the iron? A. The steam formed by the combustion of the gas condenses on striking the cold cylinder.

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J. H. asks: What is the best method of painting upon glass, so that the coloring will resist the weather? A. First draw the subject on paper, and fasten it, face downward, by pasting it at the ends, to the glass. Turn the glass over, and paint with a camel's hair pencil, the pigments being mixed with varnish. Let the outlines dry before filling in and shading. The painting may be varnished over.

J. B. N. asks: How can I transfer pictures from paper to glass? A. Coat the glass with a varnish of balsam of fir in turpentine, then press the engraving on smoothly and evenly, being careful to remove all air bubbles. Let it stand for 24 hours, then dampen the back sufficiently to allow the paper to be rubbed off by the forefinger, rubbing it till a mere film is left on the glass, then varnish again.

H. H. asks: How are organ pipes constructed, and are they tuned in the shop or after the organ is set up? Do they ever get out of tune? If so, how are they made right again? A. Organ pipes are made of wood or metal. The wooden pipes are generally nearly square in cross section, varying in size of section according to the length. Metal pipes are of different kinds of pewter, the best being the sort known as spotted metal. Pipes can be tuned before being put in the organ or afterwards. Shortening a tube raises the tone, lengthening it lowers it.

R. H. S. says: By what means can a barometer that has lost a portion of the mercury from the cistern be made to register correctly? A. It would probably be difficult to adjust it without using another barometer, unless the cistern is adjustable.

H. S. asks: 1. How does a chemist earn a living? A. Chemists make analyses, prepare reports of processes, etc. Some of them are professors in educational institutions. 2. Does he ever get rich? A. Good chemists often realize large profits from their profession. 3. What are the best books for a boy to study who wants to learn chemistry, supposing he knows nothing about it? A. "Towne's Elementary Chemistry." price $2.75, will be a good book for you to have, and you will find in it information in regard to your other questions.

J. S. asks: 1. When in a rotary engine there are two or more pistons to but one abutment and steam port, after the second piston has passed the abutment and is receiving steam, does the steam between the first and second piston cause back pressure by expanding and pressing the two pistons apart? A. In general it does. 2. Are the compound brass fishing reels cast or stamped out of sheet brass? A. We believe the cheaper styles are stamped.

W. W. M. asks: How can I cover wire for insulating it? A. A disk having a large hole in the center, and carrying two spools on which the silk is wound, is made to revolve as the wire is drawn through the hole, the ends of the silk being first tied to the wire. By varying the relative speeds of the disk and wire, the silk may be wound on as closely as may be desired.

J. P. L. asks: How can I prepare bronze powder, to be used in a semi-liquid state upon wood? I want it to dry quickly. A. The best way is to coat the wood with glue or drying oil, and dust the bronze powder over it through muslin. But the bronze powder may be mixed with drying oil, and applied with a brush.

D. B. asks: 1. How can I make small portions of yellow and green bronze, and golden ink? A. For golden ink, see p. 102, vol. 30. Yellow ink can be made with a decoction of saffron. Green ink can be made by mixing indigo carmine with picric acid. 2. Do you know of a simple prescription to take tan off the face and hands? A. Cover the skin with cold cream. 3. Which is the better, to study civil engineering theoretically, or to study it by being the assistant of an engineer? A. The latter way. 4. Name some authors who have written on the "True and Beautiful." A. Ruskin, Taine, Goethe, Matthew Arnold, and the majority of the poets. 5. What is the salary of a United States coast surveyor? A. From one hundred to one hundred and twenty-five dollars a month, we believe. 6. What are the predictions of the coming spring? Will it be early? A. Probably it will be late, but this is a mere guess. 7. Whose work on civil engineering do you regard as the best? A. Professor Rankine's.

H. J. B. asks: Is there any kind of oil that will form an explosive gas by forcing air through it? A. Probably naphtha or some other of the hydrocarbons will answer your purpose.

W. asks: Why is it that, in hewing green wood, a spark of fire is often seen down in the wood next to the ax, where there could be no grit? A. The spark is probably due to the friction between the ax and wood.

R. G. asks: Why is it that a large boiler cannot carry as much steam per square inch as a small one? A. The strength of a cylinder, other things being equal, is inversely as the diameter.

E. J. F. asks: 1. Will the magnet be less powerful in attraction under water than otherwise? A. We think not. 2. What is the best method of causing a magnet to retain its full power of attraction? A. Keep weights suspended from the armature. 3. Which is best, magnetite or iron merely magnetized, or is there no difference in the power? A. The latter is best.

T. S. V. says: I am using a 10×20 engine, running at 80 revolutions, with steam at 60 lbs., with a 3 inch exhaust pipe; and I would like to exhaust into the bottom of a tank containing six feet water. How much back pressure will it make on the engine? A. About two and three quarter pounds per square inch.

J. A. B. asks: Would a steam boiler explode with the same noise and throw pieces of the boiler as far if it exploded under hydraulic pressure at 150 pounds to the square inch as it would under the same pressure of steam? A. The explosion would generally be the most violent in the case of steam.

N. L. T. asks: 1. Why can a kettle of boiling water be held on the hand without inconvenience as long as it boils, but as soon as it stops the heat becomes intolerable? A. If such is the fact, it is probably because water in boiling requires so much heat that it is abstracted from surrounding objects. 2. Can heat be transmitted through a vacuum? A. We think so. 3. Why are rifle balls made conical at one end, and flat and sometimes concave at the other? Would they not be more effective if made tapering to both ends, as in that case no vacuum is formed after the ball, the air flowing in behind it instantaneously? A. They are made concave at one end, in order that they may spread, and fill the grooves of the rifle barrel.

O. K. asks: 1. Is the White House at Washington a wood, brick, or stone building? A. It is built of freestone. 2. Has it ever been rebuilt? A. We think not. Why is it called the White House? A. Because it is a white house.

W. B. N. says: A friend claims that, in setting logs for sawing, the eccentric blocks, making two motions for one inch, will not throw the log as hard as setting the log by one motion with the double rack and pinion. There is no back lash in either case, and the log is to be moved the same distance in the same time. I claim that, if there is any difference, it would be in favor of my plan with the double rack and pinion. He is sure that he is right, and will not let any one decide. I ask for your opinion. A. It is difficult to determine which is correct without a practical test with the two devices.—J. E. E., of Pa.

W. M. J. asks: What is the best kind of saw to saw plow beams, wagon fellies, and wagon hounds? How many plow beams are a day's work for one man, cut from plank of the proper thickness for common two horse plows? Is cutting the lumber or logs into plank the proper way to get out plow beams, or would it be better to saw the timber or logs to the shape of beam, and then slit up to the thickness of beams? A. The logs are first sawn into plank to the proper thickness for the beams, and then to a pattern marked with the required shapes. A strongly built jig or band sawing machine is used for sawing the curves or the curved way of the beam. The first cost of a band sawing machine would probably be more than for a jig saw, but it would saw more rapidly. So much depends upon conditions that it is impossible to give an approximate estimate of a fair day's work.—J. E. E. of Pa.

W. J. says: 1. I have a theory that a balloon could be guided at will by attaching to it a conical shaped apparatus, made of light material and hollow, the open and large end to be fastened to one side of the balloon, the other end converging to a point. The theory is based on the principle that the balloon with the above attachment offers less sail-like surface to the wind, and consequently would be enabled to sail against currents of air. What is your opinion? A. We do not think that this arrangement will enable you to do what you propose. 2. Would not perpetual motion be possible if it were not for the law of gravitation? A. Possibly it would. 3. What is your opinion of the following proposition: If perpetual motion is ever invented, will it work by magnetism or attraction of magnetic force? A. No. 4. Has there been anything invented to condense all the steam from a steam engine and return it to the boiler. If so, what is the percentage of waste? A. Yes. There is no waste, if the apparatus is tight. 5. Does the patentee of an invention possess any certificate to show that his invention is patented? A. No. 6. Is there any instrument that will detect the presence of a metal in the earth. A. No.

W. S. C. asks: 1. If the same pressure is brought to bear on every part of the interior of a steam engine and boiler, why are they made of different strengths? For example, the boiler is ¼ inch thick, the live steam pipe is ⅛, and the steam chest and cylinder sometimes one inch and more. A. The strength of a cylinder, other things being equal, increases as its diameter is decreased, consequently small cylinders do not require to be made as thick as large ones. 2. How is it that a steam boiler can pump water into itself? It seems to me that there would be a back pressure on the pump piston head. A. The steam piston is larger than the water piston, so that the pressure per square inch on the water piston is greater than the boiler pressure. 3. If it takes 10 ordinary horses to run a machine at the required space, what sized engine would do the same work? A. An average horse performs about half an engine horse power, when working in a gin or mill, so that an engine of five horse power would generally do the work of 10 horses. 4. Why can a horse pull more when he is hitched directly to the load than he can 100 yards from it by a rope, deducting the weight of rope? A. We are by no means certain that this is a fact.

C. H. W. asks: How is curd soap made? A. By using tallow for the grease and soda for the alkali.

A. B. says: 1. In February last, while plowing a piece of land, I found, at a depth varying from 3 to 6 inches, a large number of honeycombed insect nests. These nests were of various sizes, but, for the most part, varied from 2½ to 3 inches in width, about 4 inches in length, and about 1½ inches thick. These nests are somewhat oval, inclining to flat on the top and bottom, and have quite a number of honeycomb cells, varying generally from six to twenty-four, which contain the cocoon of the insect. These nests are made of clay, somewhat like the dirt dobbers. Can you inform me what bug or insect could have made such a nest, what its habits are, etc.? A. The insect which you describe appears to be a kind of wasp, of which there are two descriptions, the social and the solitary. The solitary wasp sometimes builds its nest in the ground, while the nests of the social insect are sufficiently familiar to us hanging from trees and fences. Consult an encyclopedia, article "wasp." 2. What is the best method of mixing white lead or zinc for painting wood? A. White lead and zinc are mixed with boiled linseed oil to a proper consistence for paint. 3. In vol. 28, No. 26, you published a new specific for rheumatism. It will be valuable to many if you republish it. A. Propylamin is the specific referred to. Wertheim prepares it by the decomposition of narcotine and codeine by alkalies. Dose, 5 drops in a tablespoonful of peppermint water every 2 hours.

C. S. A. asks: If a magnet were made in the shape of a ring, of the ordinary thickness, would not each molecule have polarity in the same directions as the whole magnet? A. In a bar magnet the magnetic power is most intense at the two extremities or poles, the middle portion showing hardly any or no magnetism. A circular disk or ring could be magnetized in the same way, the position of the poles depending upon the manner in which it was magnetized.

G. M. G. asks: Why is it that metronomes, for beating time in music, are not made in this country? A. Make one for yourself by taking a cheap clock movement, and substituting for the pendulum a wire with a sliding weight. Mark the wire with a file at the different points of graduation.

R. J. asks: 1. How can I make phosphate of calcium? A. By phosphate of calcium, we suppose, you mean calcium phosphate or phosphate of lime. The former term and analogous ones we consider both confusing and uncalled for in chemical nomenclature, although some chemists affect them. Phosphate of lime occurs naturally in the mineral apatite, and consists to a considerable extent in bones. In chemistry there are various phosphates of lime, depending upon the amount of base present. To form a basic phosphate, add a solution of basic phosphate of soda to a solution of chloride of calcium. 2. Can you tell me how to dissolve old rubber boots, etc., on a large scale? A. Bisulphide of carbon is a good solvent for india rubber. 3. Which is proper in speaking, to say "I can't" or "I con't"? A. The vowel a in "can't," abbreviation of "cannot," is sometimes pronounced with the a short and flat, and sometimes with the a broad and long, but never, properly, with any sound of o, as in "cont."

R. F. Jr. asks: 1. Will you please give a practical method for testing the explosive nature of the several brands of burning oil? A. Oil that will not take fire when a lighted match is held to it may be considered tolerably safe. 2. In a recent number you gave a recipe for a paint dryer, which named gum lac as one of the ingredients. Is there any other name for that article more familiar to the trade? A. We think the name gum lac is applied to all the varieties in the market, namely, stick lac, the crude product, seed lac, in a granulated form, and shellac, which has undergone a purification.

J. V. D. says: After getting up steam on a Monday morning, I went to start my engine when, after about five or six turns, there was a loud report inside of the boiler, which jarred the whole mill. In about two seconds there was another and louder one, and then the boilers went on all right. On the next Monday morning they acted similarly. In the first case, the steam fell from 70 to 30 lbs., and in the second from 40 to 20. What was the cause? A. It may be that the pipes connecting the boilers with the steam drum had been choked with ice or something else, which would account for the accident.

E. S. H. asks: How can I make a safety fuse, to burn at least 5 minutes? A. Soak a plaited cord in a solution of saltpeter.

S. asks: 1. How may I prove meerschaum to show that it is not imitation? A. This is the work of an expert. 2. How may it be made white, after it has become colored? A. We think it can be done by heating.

H. S. asks: If I fill a cask with steam from water at a heat so that the pressure will raise a safety valve weighted to one pound to the square inch, and then allow the steam to condense, what proportion of vacuum will there be in the cask? What proportion of the cask would fill with water by suction caused by the condensation of the steam, if the cask is connected by a suitable pipe with a water in a well at the depth of 24 feet, the pipe being full of water? A. If the steam is condensed, there will be practically a perfect vacuum, and the cask will become filled with water from the well.

W. F. M. B. and N. C. R. ask: Is the law, passed some time between 1866 and 1869, requiring all persons in charge of steam boilers and engines to be examined by commissioners appointed for that purpose, still in force? A. The United States law applies only to engineers of steam vessels. There are local laws in most of the States. It is very questionable in the light of the working of the present United States law whether government regulations affecting all persons in charge of steam boilers would be desirable.

T. H. E. asks: In soldering two pieces of iron together (a pair of gun barrels, for instance), after they have been thoroughly cleaned, tinned, and fastened together with binding wire, and warmed so that a thin sheet of solder applied to the joint will melt, is there anything besides resin that will make the solder flow as it ought, to make a good job? Resin is disagreeable to the workman, besides leaving a dirty, black color on the iron, which is difficult to remove. A. To 2 ounces of muriatic acid, add small pieces of zinc until bubbles cease to rise. Then put in half a teaspoonful of sal ammoniac and 2 ounces of water.

H. E. F. asks: Is vulcanized rubber the same thing as gutta percha? A. No.

G. M. A. asks: Is there a garden gate which opens and closes automatically? A. Such a gate is described on p. 406, vol. 25. 2. Is there any method to cement mica to copper, tin, glass, or another piece of mica? A. The cement described in our answer to R. L., on p. 90, vol. 30, will answer the purpose.

W. L. asks: Is there any chemical that can be applied on glass, tin, or paper, which will be visible only through colored or stained glass? A. We are not aware of the existence of any such substance.

M. H. A. asks: If I take equal parts of block tin and quicksilver and unite them together by heat, could this be used for a polish for cleaning knives, forks, etc.? I propose to use muriatic acid and then apply the tin and quicksilver; would it adhere so that they could be used? Would there be any danger in using such articles? A. Your process might answer for tinning, and you can easily try the experiment, but amalgamated articles would be objectionable for culinary purposes.

M. B. asks: How can I make molds to cast silver, so that the silver will flow well and cast smoothly in casting small articles? A. You can make molds for silver similar to those which are used for fine cast iron castings. For a smooth facing, fine soapstone or plumbago may be used.

A. A. S. asks: Has hydrogen ever been decomposed? A. We have seen no authentic statement to the effect that it has.

A. S. says: An engineer of some experience has been building engines with concave pistons and corresponding convexity of the cylinder heads, taking steam in the center of the pistons by an arrangement of ports cored out of the heads, claiming that he gains a greater effective pressure on the piston by that shape. He states that, on a 4 inch cylinder, he gains 2 square inches. I claim that, no matter what the shape of piston or head, the size of cylinders being equal, the pressure will be the same as in the common engine. A. We think you are right.

W. S. W. asks: How are Japanese scintillettes made? A. Japanese scintillettes consist of pencils of rolled paper, one extremity of which, to the extent of about half the length of the pencil, is filled with a composition which burns with a red flame. It is ignited by holding the fine extremity in the hand, while the other end containing the mixture is held for a moment in a flame. The composition may be made to suit the fancy, the chief ingredients being probably sulphur, meal powder, or chlorate of potash, etc.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

S. E. W.—Your boiler sediment consists of some saline material. So far as we can judge without a chemical analysis, it is common salt. The water used is apt not only to form scale, but to corrode the iron. The remedy is to distil, and to use the water from the condensed steam as far as practicable.

G. W. P. Jr.—The stones you send are garnets. When very perfect and of a pure color, they are sometimes reckoned among precious stones. Fine specimens are found in Ceylon and Brazil. We do not consider your specimens of any particular value. The garnet is a double silicate of alumina and lime, colored with manganese and iron.

L. T. H. asks: How can I make imitation ivory billiard balls without pressure?—E.E.S. asks: How is moss prepared for finishing wax flowers? Can it be bleached and made to resemble white wax, to be put in white bouquets? How can small monopetalous corollas be made of wax, so that they will have the delicate fragile appearance of natural flowers? With what should the colors be mixed, so that they can be put on the wax as evenly as on paper? How can the bloom and flock be made to adhere to the wax?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Spider's Web. By J. H. B.

On the Hot Springs of Nevada. By G.A.F.

On the Centralization of Matter. By A. D.

On Ventilation. By A. R. M.

On the Relative Attraction of the Earth and Sun. By A. R. Jr. and by E. W.

Also enquiries from the following:

A. W.—G. A.—S. R.—G. B.—A. P.—J. W. T.—R. J. W—W. H.—E. C. B.—E. N.—A. Th.—D. A. S.

Correspondents in different parts of the country ask: Who makes match-splitting machines? Who makes balanced slide valves for use on locomotives? Who sells a hash machine? Who makes woolen machinery, such as pickers, breaker cards, and finisher cards? Who manufactures balloons? Who makes a machine which prints by touching keys, similar to a piano? Where are machines for making friction matches sold? Who makes movable calks for horseshoes? Who makes broom handle machinery? Who makes ditching machines? Where can machines for pressing coal dust into blocks be obtained? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

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January 20, 1874,

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Motion, converting, W. F. Barnes	146,636
Nut and bolt fastening, J. C. Tiffany	146,724
Nut lock, H. P. Hood	146,532
Oil tank, H. Titus	146,61
Ores, treating, J. H. Boyd	146,509
Organ, reed, R. Burdett	146,511
Organ stop action, G. B. Kelly	146,686
Packing, metallic piston, V. H. Higgins	146,591
Painting buckets, etc., W. M. Dunham	146,517
Paper machine, B. F. Field	146,520
Paper, finishing printed, J. Morris	146,605
Picks, manufacture of, J. C. Klein	146,597
Pin, dipper, J. Poznauski	146,552
Pipe, irrigation, N. Clark	146,572
Pipe joint, W. P. Valentine	146,622
Pipes, lapping joint for, H. K. Cruit	146,657
Plane, bench, H. A. Gatley	146,588
Planer, reversing gear, E. J. Manville	146,539
Planter, hand, D. Broy	146,510
Planter, seed, W. C. Pierce	146,613
Plow, J. P. Batten	146,638
Plow, C. Gaines	146,524
Plow, Matteson *et al.* (r)	5,735
Plow, one wheeled riding, R. C. Airey	146,562
Pocket safety attachment, W. H. Cairns	146,570
Press, copying, W. U. Fairbairn	146,519
Printer's rule, C. N. Morris (r)	5,736
Pulley, band, E. Sanford	146,615
Pulley, door, W. A. Holwell	146,675
Punch and die, metal card, D. Foxwell	146,665
Railway rail, G. O. Kunkle	146,599
Railway switch, G. D. Davis	146,516
Railway switch, C. Naucke, Jr	146,626
Railway track clearers, operating, J. W. Comins	146,655
Railway transfer tables, operating, Jones *et al.*	146,685
Rake tooth fastener, J. Case	146,571
Reamer for metal, J. W. Barsantee	146,637
Register, etc., passenger, J. & M. Medina	146,604
Roll, wedge, J. C. Klein	146,598
Roof, fire and waterproof, T. New	146,608
Roofing, metallic, C. A. Scott	146,555
Safe or sideboard, suspension, J. Rissel	146,711
Sash fastener, J. S. Barnum	146,504
Saw, diamond, J. D. Husbands, Jr	146,681
Saw filing machine, M. S. Brewer	146,645
Saw for sawing stone, J. D. Husbands, Jr	146,680
Saw jointer, H. Parron	146,567
Saw mandrel, J. W. Bugbee	146,648
Saw teeth, M. J. Rahilly	146,708
Saw teeth, device for swaging, E. Buell	146,647
Scales, guard for drafting, S. Haslett	146,673
Scales, platform, H. B. Osgood	146,702
Sewing machine, J. H. Applegate	146,502
Sewing machine, W. G. Beckwith	146,505
Sewing machine, S. S. Black	146,642
Sewing machine, G. W. Hunter	146,679
Sewing machine, F. B. Taylor	146,721
Sewing machine corder, W. Wilson	146,736
Sewing machine hemmer, J. F. Johnson	146,684
Sewing machine needle sharpener, J. L. Woodruff	146,628
Sewing machine thread cutter, J. West	146,561
Shafts, bearing for, J. Haas (r)	5,732
Shoe soles, shaping, W. A. Perkins	146,547
Shoes, manufacture of, Collyer *et al.*	146,654
Shutter, fireproof, B. Hoskins	146,538
Skirt binding, W. H. Gallup	146,667
Skylight bar, C. Sellman	146,556
Statuary, etc., making, J. Stamm	146,720
Stones, facing cobble, W. M. Hughes	146,592
Stove, base burning, W. Hailes	146,527
Stove-polishing machine, J. F. Landis	146,691
Suspenders, F. O. Painter	146,609
Swift and reel, A. Totten	146,558
Syllabication of words, C. Allen	146,681
Tag-making machine, C. S. Hutchinson (r)	5,738
Telegraph, fire alarm, L. H. McCullough	146,698
Telegraph lines, underground, W. Mackintosh	146,695
Thrashing machine feed, Watkins *et al.*	146,625
Ticket printing, etc., R. D. Ingersoll	146,535
Tobacco stripping, etc., McMain *et al.*	146,540
Toy gun, Alexander & Gordon	146,563
Track clearer, J. S. Hagerty	146,670
Trap, animal, J. M. Marberry	146,601
Trunk, cylindrical, H. H. Scoville	146,616
Tube welding mandrel, H. K. Flagler	146,521
Undershirt, A. Conger	146,656
Valve, balanced slide, W. Obenchain	146,701
Valve, vacuum relief, A. J. Stevens	146,617
Valve, safety, G. C. Schmidt	146,716
Valves, refitting, W. W. Allmand	146,633
Vault door fastening, J. B. Cornell	146,575
Vessels, raising sunken, H. F. Knapp	146,689
Wagon standard, W. T. Nell	146,700
Wash board, H. Way	146,560
Washing machine, J. Darlington	146,578
Washing machine, T. C. Eberhardt	146,583
Washing machine, A. Israel	146,682
Washing machine, E. Marshall	146,602
Water meter, J. Waterhouse	146,624
Wells, method of working oil, M. Lythe	146,600
Windmill, W. C. Nelson	146,607
Windmill, T. O. Perry	146,548
Winnower, reciprocating, T. Bolles	146,643

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

27,973.—PRINTING PRESS.—F. O. Degener. April 8.
28,014.—METALLIC CASK.—W. B. Scaife. April 8.
28,043.—TEMPLE.—J. H. Woodward. April 8.

EXTENSIONS GRANTED.

26,891.—SPECTACLE CASE CATCH.—G. N. Cummings.
26,902.—PLANING MACHINE.—S. S. Gray.
26,906.—SEWING MACHINE.—A. F. Johnson.
26,914.—CLOTHES WRINGER.—R. O. Meldrum *et al.*
26,919.—REPEATING FIRE ARM.—W. H. Morris *et al.*
26,948.—SEWING MACHINE STITCH.—A. F. Johnson.
26,952.—LAMP.—G. Neilson.

DISCLAIMERS.

26,919.—REPEATING FIRE ARM.—W. H. Morris *et al.*
26,919.—REPEATING FIRE ARM.—W. H. Morris *et al.*

DESIGNS PATENTED.

7,112 to 7,115.—CARPETS.—A. Heald, Philadelphia, Pa.
7,116.—NECK RUFF.—U. D. Mannville, New Haven, Ct.
7,117.—BIRD CAGE.—J. Maxheimer, New York city.
7,118 to 7,124.—OIL CLOTHS.—C. T. & V.E. Meyer, Bergen, N. J.
7,125 and 7,126.—CARPETS.—C. Righter, Philadelphia, Pa.
7,127.—OIL CLOTH.—J. Barrett, New York city.
7,128 to 7,132.—OIL CLOTHS.—J. Hutchison, Newark, N. J.

TRADE MARKS REGISTERED.

1,598.—FLOUR.—J. Hannan, Chambersburg, Pa.
1,599.—GYPSUM.—H. C. Hulbert, New York city.
1,600.—MEDICINE.—J. Pownall, Williamsburg, N. Y.
1,601.—MATCHES.—W. Roeber, New York city.
1,602 to 1,605.—WHISKIES.—G. W. Kidd & Co., N. Y. city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 3, 1873.

3,058.—T. G. Messenger, Loughborough, Eng. Improvement on the coupling of pipes and in the fittings therefor, called "Messenger's Improved Pipe Joints." Jan. 3, 1874.

3,059.—J. D. Marshbank, Harrisburgh, Pa., U. S., and J. R. Annett, Montreal, P. Q. Improvements on a cupola furnace for melting iron, called "Marshbank's Foundry Cupola." Jan. 3, 1874.

3,060.—J. Mc. Armour, Syracuse, Onondaga county, N.Y., U. S. Improvements in knitting machines, called "Armour's Improved Knitting Machine." Jan. 3, 1874.

3,061.—E. C. Goddard, Sweetsburgh, Missisquoi county, P. Q. Improvements on the Ithaca Wheel Rake, called "Goddard's Rake Lever Attachment." Jan. 3, 1874.

3,062.—J. V. Browne, New York city, U. S., and R. P. Fidlar, Sterling, Hastings county, Ontario. Improvements on mucilage bottles, called "Vincent's Self Feeding Mucilage Bottle for the Economical Use of Mucilage." Jan. 3, 1874.

3,063.—S. Collinson, St. Catharine's, Lincoln county, Ontario. Machine for cutting sickles, called "Collinson's Reaper Sickle Cutter." Jan. 3, 1874.

3,064.—S. Collinson, St. Catharine's, Lincoln county, Ontario. Improvements on tongs used in machinery, called "Collinson's Patent Tongs." Jan. 3, 1874.

3,065.—E. Sahm, Greenville, Mercer county, Pa., U. S. A combined square and gage for carpenter's use, called "Sahm's Combined Square and Gage." Jan. 3, 1874.

3,066.—Wm. Todd, Portland, Cumberland county, Me., U.S. Improvements on car couplings and the method of attaching them to the cars, called "Todd's Car Coupling." Jan. 3, 1874.

3,067.—G. M. Skinner, Gananogue, Leeds county, Ontario. Improvements on spoon baits for fishing, called "Skinner's Fluted Trolling Spoon." Jan. 3, 1874.

3,068.—Wm. Gowen, Wanson, Marathon county, Wis., U. S. Improvement on saw mills, called "Gowen's Improvement in Saw Mill." Jan. 3, 1874.

3,069.—G. B. De Boucherville, Quebec. *Amelioration a la maniere de se servir d'une corde pour echapper a un incendie*, called "*Sauveteur d' Incendie*." A new mode of using a rope in case of fire. Jan. 3, 1874.

3,070.—J. A. Green, Hamilton, Ontario. Improvements in railway switches, called "Green's Self Adjustable Railway Switch." Jan. 3, 1874.

3,071.—Wm. Hamilton, Neversink, Sullivan county, N. Y. U. S. Improvements on machines for making ox shoes, called "Hamilton's Ox Shoe Machine." Jan. 3, 1874.

3,072.—D. J. Casement, Painesville, Lake county, Ohio., U. S. Improvement on seal locks, called "Casement's Seal Lock." Jan. 3, 1874.

3,073.—J. Wilson, Kingston, Ontario. Improvements on paddle wheels, called "Wilson's Paddle Wheel." Jan. 3, 1874.

3,074.—A. Amos, Potsdam Junction, St. Lawrence county, N. Y., U. S. Improvements on horse hay rakes, called "Amos' Improved Horse Hay Rake." Jan. 3, 1874.

3,075.—C. McPhail, Big Harbor, Inverness county, Nova Scotia. Improvements on armor for ships of war, called "McPhail's Armor for War Ships." Jan. 3, 1874.

3,076.—C. H. Chapman, Shirley, Mass., U. S. Improvements on machinery for weaving tape, called "Chapman's Tape Weaving Loom." Jan. 3, 1874.

3,077.—Wm. McAllister, St. Lawrence, Mass., U. S. Improvements for protecting buildings from fire, called "The McAllister Fire Protector." Jan. 3, 1874.

3,078.—I. Woolridge, Dean's Corner, Lake county, Ill., U. S. Improvements on land rollers, called "Woolridge's Improved Land Roller." Jan. 3, 1874.

3,079.—W. C. Davol, Jr., Fall River, Bristol county, Mass., U. S. Improvements in hose leak stoppers, called "Davol's Fire Hose Leak Stopper." Jan. 3, 1874.

3,080.—I. Helton, Carter's Depot, Carter county, Tenn., U. S. Improvements in a medical compound, called "Fever Specific," the title or name whereof is "Fever Specific Compound." Jan. 3, 1874.

3,081.—R. H. Hudgin, Howard, Kent county, Ontario. Improvements in the formation and construction of gate posts, called "Hudgin's Gate Post." Jan. 3, 1874.

3,082.—M. Boch, Brooklyn, Kings county, N. Y., U. S. Improvements on fasteners for shoes, etc., called "Boch's Improved Shoe Fastener." Jan. 3, 1874.

3,083.—J. Rogers, Brooklyn, Kings county, N. Y., U. S. Improvements on apparatus for manufacturing lamp black, called "Rogers' Improved Lamp Black Furnace." Jan. 3, 1874.

HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co. 37 Park Row, New York.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co. 37 Park Row New York.

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Copies of Patents.

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The total expense, in ordinary cases, to apply for a Canadian patent, is $75, U. S. currency. This includes the government fees for the first five years, and also our (Munn & Co.'s) charges for preparing drawings, specifications and papers, and attending to the entire business. The holder of the patent is entitled to two extensions of the patent, each for five years, making fifteen years in all.

If the inventor assigns the patent, the assignee enjoys all the rights of the inventor.

A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

If the invention consists of a composition of matter, samples of the composition, and also of the several ingredients, must be furnished.

Persons who desire to apply for patents in Canada are requested to send to us (MUNN & Co.), by express, a model with a description, in their own language, showing the merits and operation of the invention, remitting also the fees as above for such term for the patent as they may elect. We will then immediately prepare the drawings and specification, and send the latter to the applicant for his examination, signature, and affidavit. It requires from four to twelve weeks' time, after completion of the papers, to obtain the decision of the Canadian Patent Office. Remit the fees by check, draft, or Postal order. Do not send the money in the box with model. Give us your name in full, middle name included

Inventions that have already been patented in the United States for not more than one year may also be patented in Canada.

On filing an application for a Canadian patent, the Commissioner causes an examination as to the novelty and utility of the invention. If found lacking in either of these particulars, the application will be rejected, in which case no portion of the fees paid will be returned to the applicant.

Inventors may temporarily secure their improvements in Canada by filing *caveats;* expense thereof, $35 in full.

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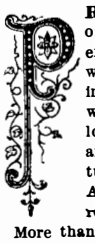
Practical Hints to Inventors.



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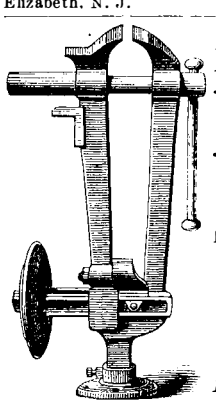

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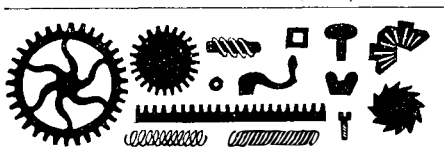

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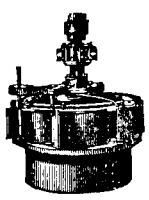

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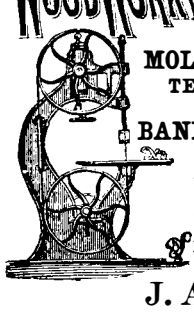

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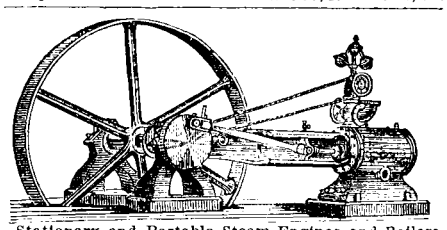

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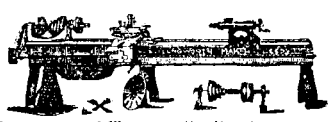

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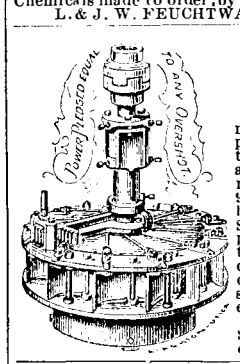

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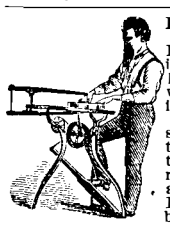

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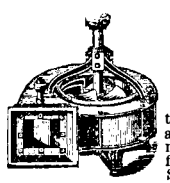

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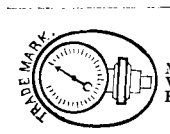

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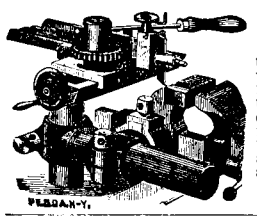

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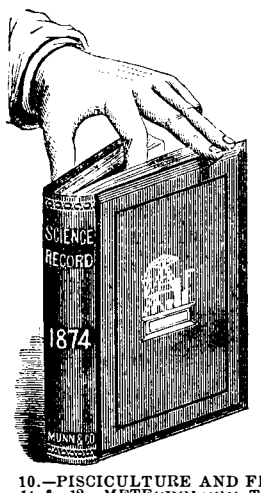

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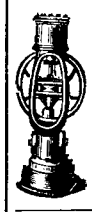

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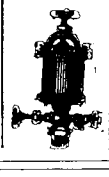

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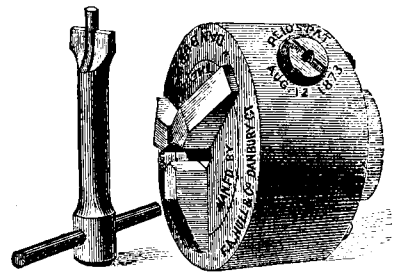

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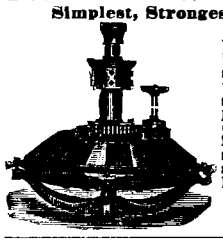

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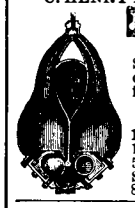

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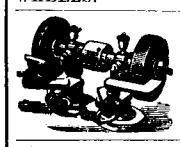

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